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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

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13 to 15, Wilson Street, London, E.C.2.

Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

Forthcoming Events.

JANUARY 27.

Institution of Civil Engineers:—Ordinary meeting. "The Strength of Arc-Welded Joints," Paper by F. R. Freeman, B.Sc.

Sheffield Metallurgical Association:—"The Selection of Suitable Steels for Gears," Paper by Francis W. Rowe.

FEBRUARY 2.

Royal Society of Arts:—Cantor Lecture II on "Some Modern Developments in Microscopy," by L. C. Martin, D.Sc.

Institute of British Foundrymen.

JANUARY 30.

London Branch (Junior Section):—Ordinary meeting at 49, Wellington Street, London, W.C.2.

JANUARY 31.

Newcastle-upon-Tyne and District Branch:—Ordinary meeting at Newcastle-upon-Tyne. "The Sand Problem," Paper by H. F. Coggon.

East Midlands Branch:—Annual general meeting at Loughborough. Short Paper competition.

The Final Outcome.

We have lately been paying some attention to the incidence of weldings as a competitor of castings, and feel that this question has not been regarded in the proper perspective. Primarily, engineers are far too apt to regard tensile strength as the alpha and omega of engineering requirements, forgetting that rigidity is equally important. For instance, the essential property of a bed plate is rigidity and tensile strength is usually of secondary importance. Yet the welding industry is making intense competition in certain branches. Another phase of their activities is the making of motor casings, as it carries, maybe, some advantage in cost, and is made from a material having a certain amount of elasticity. Yet if a weight is accidentally dropped on one, a dent will be equally as disastrous as a break. The cast-iron casings are rigid and less immune to rusting.

One of the worst cases of inefficient replacement of castings by weldings which has recently come to our notice is that of a casting which was made for 12s. It was decided that a welding would be cheaper, and the job was redesigned. It then cost 8s. as a welding, but in its new form the foundry manager concerned guaranteed to make it for 3s. It is very distressing to the foundry industry that the engineers permit this new and relatively inexperienced welding industry to take charge of designs, alter them as it likes for cheapness in manufacture, yet they will not accord the same facility to foundrymen. The welder is to be congratulated on the confidence he enjoys, and we enlist his aid to achieve what is bound to be the ultimate outcome in structural engineering, that is the fabrication of the bases and shells of jobs by casting and the additions of bits of brackets and the like by welding.

By the way, it would interest the founding industry if the welders would define the difference between a weld and a braze. Actually, foundrymen viewing welds see from the microstructure three distinct types:—(1) Where the structure of the parts and the weld are one and the same; (2) where the weld metal is somewhat different from the two parts, thus giving three strata, and (3) where the weld metal is quite different, but forms a weld on either side of itself before joining up with the original parts, thus giving five structures.

Realities and Problems.

The National Federation of Engineering and Allied Employers (E.E.F.) recently issued a booklet under the above title, emphasising that the sales of British engineering products were declining, and that skilled men were leaving the industry through lack of work. Foundry work is definitely claimed as part of the engineering industry. Unemployment, expressed as a percentage of total number of insured persons unemployed, is steadily mounting. The figure of 14.5 per cent. for 1926 (the year of the General Strike) had steadily decreased during the succeeding years until in 1929 it was 8.6 per cent. During every month of 1930 an increase was recorded, and the October figure is 19.4 per cent.; that is, one insured employee in five is out of work.

It is claimed that rationalisation has not been so rapid as to be responsible for such an increase, and, indeed, world tendencies show that every country is suffering in the same way.

Export trade statistics show that while in 1913 the average value per ton of machinery exports was £49, in 1930 it was £97. Imports were in 1913 valued at £72 per ton and in 1930 at £163 per ton. Before the war we supplied 57 per cent. of the textile machinery exported, but now the figure is 41 per cent. Germany's figure has increased from 36 per cent. to 39.3 per cent., while that of U.S.A. is 2.8 per cent. to 8.3 per cent. Our share of machine-tool work has declined from 11.5 per cent. to 8.3 per cent., and that of the U.S.A. has increased from 37.6 to 42.3 per cent. In agricultural machinery our share in 1913 was 21.7 per cent. It is now 5.7 per cent., while that of U.S.A. has increased from 61.3 to 83.1 per cent.

Perhaps our most enterprising engineering branch is the electrical industry. By 1925 it had made itself the greatest exporter of electrical machinery, and it remained so until 1929. To-day America is ahead of us, and Germany, who led in 1913, is challenging both countries. The report quotes the figure of 10 per cent. suggested by Mr. Lloyd George as the cost reduction needed. Foreign costs in engineering are 2½ per cent. to 40 per cent. below ours.

The report goes on to point out that the engineering industry as a finishing industry has to bear the whole of the accumulated charges of other industries supplying it with raw material, such as wages, national and local taxation and so on. The engineering industry cannot of itself control 70 per cent. of the costs which go into the cost of its products.

The principal causes of high costs are wages, rates and taxes, trade-union restrictions and difficulties caused by legislation. These are examined in detail in the report, and we shall return to this at a later date. In the meantime it is sufficient to say that, while in actual cost per ton, castings make up a smaller proportion of the total cost of a machine than any other part, the quantity used, amounting to a third to two-thirds of the average machine, makes the cost of foundry products an appreciable part of the total. Hence any means of reducing costs is being eagerly considered by the industry, and any relief from outside burdens would be of great assistance.

I.B.F. Elects New Members.

At a meeting of the Council of the Institute of British Foundrymen, held at the Midland Hotel, Manchester, last Saturday, the following gentlemen were elected to its various grades of membership:—

As Members.

D. Bagley, engineer, Low Moor Coke Company, Bradford.

F. J. Barraball, foundry equipment engineer, Blackfriars Foundry Company, London.

A. Barrow, foundry foreman, English Steel Corporation.

J. W. Eckford, consulting engineer, 4, Mosley Street, Newcastle.

F. Griffiths, foundry manager, English Electric Company, Bradford.

H. J. Henbrey, director, Rustnot Parent Company, Bradford.

A. Palmucci, mechanical engineer, Westinghouse Italiana Frenie Segnate, Italy.

W. Twaddle, engineer draughtsman, Bagshawe & Company, Limited, Dunstable.

H. Wharton, engineer salesman, J. W. Jackman & Company, Manchester.

Hon. J. K. Weir, chief assistant to Board of G. & J. Weir, Limited.

D. H. Young, assistant manager, Harland & Wolff.

I. H. Baker, representative, British Pigirons, Limited, London, S.W.1.

J. Duff, foundry manager, Staveley Coal & Iron Company.

F. Jacques, assistant foundry manager, Staveley Coal & Iron Company.

M. Nelson, representative, J. Grayson Lowood & Company, Sheffield.

As Associate Members.

E. Briddon, moulder, Bryan, Donkin Company, Chesterfield.

W. Bryan, moulder, Niagara Foundry Company, Bilston.

L. D. Drake, foreman, British Piston Ring Company.

S. F. Geary, foundry chemist, B.T.H., Rugby.

E. Morgan, M.Sc., research metallurgist, B.C.I.R.A., Birmingham.

W. G. Morgan, foundry engineer, A. Herbert, Limited, Coventry.

W. L. Selkird, assistant foundry manager, Davy Bros., Limited, Sheffield.

J. Smith, foundry engineer, Niagara Foundry Company, Bilston.

P. J. Ward, works chemist, Staveley Coal & Iron Company, Limited, Chesterfield.

E. Wragg, moulder, Bryan Donkin Company, Chesterfield.

A. Boswell, foundry foreman, Gresham & Craven, Salford.

G. E. Chesters, assistant foreman, L.N.E.R., Doncaster.

A. H. Cullern, foreman moulder, Drakes Gas Engineers, Ovenden, Halifax.

J. Goodfellow, foreman moulder, Wilson's Forge, Bishop Auckland.

T. Hamilton, foreman moulder, Crumble Hulme, Limited, Bolton.

E. Jackson, moulder, Beyer, Peacock, Manchester.

J. K. Jackson, moulder, Stanton.

E. J. Kelly, moulder, Brown Lenox, Pontypridd.

J. Liversidge, foreman moulder, Brightside Foundry & Engineering Company, Sheffield.

J. D. Marriner, foundry representative, Stobie Steel Company, Dunston-on-Tyne.

A. U. B. Marshall, pattern moulder, Bennett's Iron Foundry, Heaton Moor.

W. Redmayne, patternmaker, Wilson's Forge, Bishop Auckland.

J. A. Reiss, assistant secretary, Staveley Coal & Iron Company, Chesterfield.

W. Ritchie, foreman patternmaker, Wycliffe Foundry, Lutterworth.

A. E. Scrayfield, assistant chemist, English Steel Corporation, Sheffield.

J. H. Sherlock, foundry foreman, "Qualcast," Derby.

S. Simpson, metallurgist, Armstrong, Whitworth.

J. S. Stark, foreman patternmaker, Carrick & Foster, Bingley.

J. Aitken, foreman moulder, Babcock & Wilcox, Renfrew.

F. Gentles, assistant foundry superintendent, Babcock & Wilcox, Limited.

F. H. Keating, metallurgist, G. & J. Weir, Limited, Cathcart.

J. Livingston, moulder.

J. A. Shankland, assistant foreman moulder, Blairs, Limited, Govan.

C. A. W. Tucker, moulder, Stothert & Pitt, Bath.

S. Turner, foreman moulder, Wycliffe Foundry, Lutterworth.

F. Whitehurst, foreman moulder, Wycliffe Foundry.

R. Wilkinson, assistant foundry chemist, Staveley Coal & Iron Company.

As Associates.

T. R. Ferguson, moulder, Clarke, Chapman & Company, Gateshead.

F. P. Scott, coremaker, Clarke, Chapman.

E. H. Spencer, moulder, Consett Iron Company.

J. R. Waddell, metallurgist apprentice, Blakeborough & Sons, Bradford.

H. Wilton, assistant metallurgist, Armstrong, Whitworth.

G. Wallace, journeyman moulder, Glenfield & Kennedy, Limited, Kilmarnock.

Notes from I.B.F. Branches.

Newcastle.—The annual dinner is to be held on Saturday, February 14, 1931, in Rinaldo's Restaurant, Newcastle, at 7 p.m. This function is open to members, ladies and friends, and tickets (6s. each) can be obtained from Mr. F. Sanderson, 1, Ellwood Gardens, Gateshead-on-Tyne. The guests and speakers will include the Lord Mayor and Lady Mayoress of Newcastle-upon-Tyne, Mr. F. P. Wilson, J.P. (President of the Institute), Dr. Edgar, of the Rutherford Technical College, Mr. T. Makemson (General Secretary), Mr. V. C. Faulkner and others.

Publication Received.

The Bulletin of the Resista Iron Company (Roumania) Engineering Society. Vol. I, No. 1.

As this is in Roumanian, we were pleased to find at the end a *résumé* of the contents in French. Apparently the apprenticeship problem is world wide, for whilst, apparently, there is no dearth of entrants, systematic instruction has been neglected, but after a tour of inspection, a special school is being formed for their instruction. We must confess that what interested us the most was a series of 22 pictures of the works and some of the bridges it had built. As this is the first issue, we heartily congratulate those responsible for a very creditable production.

Book Review.

Heat-Treatment in Forging Steel, by B. SAUNDERS. Published by Messrs. Crosby Lockwood & Son, Stationers' Hall Court, Ludgate Hill, London, E.C. Price 5s. net.

This little book has been written with the object of providing the working smith with a theoretical background to his work. The choice of material presented is well balanced, except that Chapters I and VII, preparation of steels and pyrometry, could very well be omitted, whilst probably Chapter VIII, calculating, could be usefully extended. The book contains 117 pages, is well illustrated and adequately indexed.

Random Shots.

When I referred recently to some books that would be likely to suit a robust taste for holiday reading I omitted to mention the W Plan. The release of the film of this story reminded me of it. It has not only a good idea admirably worked out, but it is well written and convincing. It deals with a scheme originated by a German officer for the complete undermining of the British front in the west, followed by a surprise attack in the rear and a complete surrounding of the Allied forces. You will like it. It is, of course, by a British author.

* * *

I regard it as a sort of post-war successor to the famous "Riddle of the Sands" by Erskine Childers, in which two British officers do such good work in the lonely sand dunes and banks that fringe the low-lying coast of North Germany. In the W Plan the plot is, of course, exposed by the astuteness of a Britisher, and the story is well told.

* * *

Some day an economist will invent a sort of economic short cut. Many people ask how reductions in wages can help matters when they can only reduce purchasing power and hence demand for goods, thus fostering the very conditions we want to overcome. The truth is that our luxuries are paid for by export trade and we can only compete in export markets by reducing costs. When this is done and orders once more fill the shops, then we shall be in a position to increase wages in accordance with purely economic laws.

* * *

Well, the Prince of Wales has blessed the waltz; Amy Johnson has refused to fly to Pekin; a Bristol M.P. prefers to go without a dinner rather than year evening dress; the papers are thus full of such world-shaking news that we are never left in doubt of the stirring nature of the times.

* * *

The premature decease of Lord Melchett is lamentable, for he was doing fine work in connection with the so-called Mond-Turner conversations. The final report has recently been issued, expressing the view that the fullest consultation between the representatives of organised labour and organised employers is essential to the welfare of British industry and its future prosperity, and with it, a progressive improvement in the standard of life of the people. The basis of working accorded full recognition of the authority and representative character of the trade unions.

* * *

It is well known that there is no "dole" in the United States, and a popular newspaper is responsible for the statement that the Reichstag is to abolish the German "dole" completely, a drastic step which will be watched here with interest in view of the Royal Commission on Unemployment Insurance.

MARKSMAN.

American Museum to be Devoted to History of Steel.—The first American museum to be devoted to the story of steel will be opened in Worcester, Mass., this month. Chronological order will be observed in presenting exhibits showing the prehistoric uses of the metal bringing the development down through the ages to modern processes and typical products made of steel. The building itself will be entirely of steel in two wings. One wing will be 90 ft. in length and another 100 ft., both four stories high. From the exterior only steel and glass will appear. The structural columns will be left visible to show what is behind the brick, cement, granite and marble of all large modern structures. A frieze of steel plates of fine architectural design will be visible. There will be a steel crown moulding and wrought-iron scrolls supporting the overhanging cornice.—"American Metal Market."

The Position of the German Iron Foundries in 1930.

By Dr.-Ing. Th. Geilenkirchen (Director, German Foundry Employers' Federation).

The year 1930 opened under exceptionally unfavourable economic conditions. The prevalent note in the reflections of the industrial and daily Press was the wish that the New Year would bring about the end of the existing industrial depression. Such hopes, however, have all been dissipated. The general situation has become worse and worse; the German economic crisis has grown into a world economic crisis, and to-day the whole outlook is worse than it has ever been. Hopes of an early recovery have sunk to zero, and there is everywhere apparent a lassitude in enterprise, which must be regarded as the most serious obstacle to any recovery.

The next most important factor preventing a recovery is the great shortage of capital, which to all appearance cannot be remedied in the near future. As things are at present, the great majority of undertakings are working without profit, and where it is still possible to make profits at all, these are for the most part taxed out of existence, so that in the next few years no creation of new capital can be expected. German industry, as a whole, is at the outset burdened with a Reparations charge of some 2 milliard RM., an interest charge on the external debt of about 2½ milliard RM. and an unemployed relief charge of over 2 milliard RM. These items amount to some 6½ milliard RM. (£325 million), or one-tenth of the total national income of Germany, which must be paid out without an equivalent of any kind being received in return.

Grouping the Foundries.

It was under these conditions that the German iron foundries had to work during 1930. Even in pre-war times, however, the foundries had already become less prosperous than other industries, and it can certainly be said to-day that their position, in general, is still much worse than the average throughout the German industry as a whole. If we endeavour to examine the conditions in detail, however, we find it impossible to regard the industry as constituting a uniform whole. The foundries must be divided into groups according to their position in the industry. To do so we must first distinguish between iron foundries pure and simple and departments, and, in the latter case, between those connected with a blast-furnace plant, which produce their own raw material, while placing their castings on the market, and those connected with engineering works, which purchase their raw material, but utilise their products in their own workshops. Among the detached iron foundries we must distinguish between those producing trade or structural castings, which sell finished products for daily use or the requirements of the building trade, either as separate castings or as parts for certain units, such as stoves, assembled as rough castings or treated with some coating such as enamel, and foundries producing rough engineering castings for other engineering works.

The foundries associated with blast furnaces mainly produce large quantities of staple articles, such as pressure pipes and drain pipes, radiators and boilers, and endeavour to use a large portion of their own pig-iron in these articles. They are generally competitors in the world's market, and in regard to the prices obtainable they have to be governed entirely by world-market prices. The direct production of castings from the blast furnace, which used to be the rule in these foundries, has almost entirely ceased; in 1930 only 7,332 tons of direct castings were produced in the whole of Germany. A limited number of the large detached foundries, which have specialised in the same staple articles and market them in Germany and abroad, are in competition with the blast-furnace foundries. The majority of them also produce trade castings, manufacturing for stock and selling to the wholesale ironmongery trade.

The engineering foundries consist either of firms which were originally ordinary foundries and have gradually adopted the practice of finishing their castings for machines or machine parts or of engineering works which have taken up the production of castings in order to be independent of outside foundries for their supplies of rough castings for their own engineering works. In such foundries, therefore, the most important consideration was not that they should work at a profit but that they should

DR.-ING. TH. GEILENKIRCHEN.

be certain of being able to cover the requirements of their own engineering works rapidly, even when there was a large demand for castings, and that they should be able to adjust themselves to these requirements when new types of castings were wanted.

These conditions have been fundamentally altered in many respects during the last few years. With the general contraction in the economic life of Germany and in her industrial activities in particular, it has become considerably easier for the engineering works to cover their requirements in castings, so that they are no longer so dependent as formerly on their own iron foundries. The result is that a large number of such works have closed down their foundries and at present obtain their castings from ordinary foundries on more advantageous terms. Other engineering works have gone in the opposite direction by manufacturing not only for their own requirements but also for the general market, so that they frequently compete with the ordinary foundries to an objectionable extent.

The Devil and the Deep Sea.

The ordinary iron foundries—both those producing merchantable castings and the departmental foundries supplying engineering works with rough castings—find themselves in anything but an enviable position from an economic point of view. In obtaining their raw materials, including the fuel required for the cupolas, they are dependent upon great corporate cartels which are in a position to impose prices and terms of payment. On the other hand, they have to sell their goods to a great body of customers who, in their purchases, are compelled by their own position to force prices down along almost the whole line, regardless of whether the manufacturer of the castings makes anything out of it or not. The foundryman can protect himself against this forcing down of prices only by means of a combine, also in the nature of a cartel. Efforts to bring about such combines, however, have proved really successful only in the case of the foundries producing merchantable castings, where only a relatively small number of uniform—in some cases even standardised—products are concerned. Castings for engineering works, on the other hand, are extremely diversified, according to the nature and dimensions of the machines, and, in their case, mass manufacture has to give way to individual production.

Scrap Position.

In the costing of these, as well as in the other foundries, wages play a relatively important part. Their proportion to the cost of the finished article is between 30 and 50 per cent. As in Germany, the wages of industrial workers are compulsorily regulated by the State, it is just as impossible for foundrymen, as for other manufacturers, to adapt wages to the fluctuations of the economic situation and thus secure an adjustable factor in their costs. The one factor in costs really dependent on the economic situation is the cast-iron scrap used in the charge, which fell considerably in price in the course of last year owing to the reduced demand. At the beginning of the year the scrap dealers succeeded to some extent in improving prices by securing a relaxation of the scrap exportation prohibition, which enabled them to export considerable quantities at high prices. This outlet, however, is now closed to them, as the demand for scrap in the world's market has fallen off owing to the general economic depression, and consequently very little German scrap is bought abroad. The fall in the price of scrap has, naturally, increased its consumption in all branches of foundry production, while less pig-iron is used in the charge.

Market Conditions.

As regards the market for castings, the following particulars may be given:—The pipe market has been depressed throughout the year. Seasonal activity, such as has occurred in previous years in the spring, has this year been absent. It was only in the second half of the year that the demand appeared to revive a little, but this favourable turn soon came to nothing again. The home market for pressure pipes is extremely depressed, as at present nearly all the German municipalities are greatly in want of money and are unable to incur fresh expenditure, so that even the installation of necessary gas and water systems has been relegated to an indefinite future. In the world's market also the demand has declined, its absorption capacity for cast pipes having fallen off about 35 per cent. Among other countries, the U.S.A. and the British Dominions have considerably increased their tariffs.

On the other hand, the productive capacity of the pipe foundries has increased uninterruptedly. The large German and Saar pipe works have successively adopted the centrifugal-casting system, by means of which they can augment their production considerably. The same applies to drain pipes: the market is suffering from the complete stoppage in building, both at home and abroad. The capacity of the drain-pipe foundries, on the other hand, has been greatly increased by the adoption of the continuous-production system in many of them.

The conditions are also similar in the radiator branch. During the last few years a large

number of German ironfoundries have entered the promising field of radiator manufacture, and the American Nationale Radiatoren-Gesellschaft, which has for many years had works in Central Germany, lately erected new works of very large capacity at Neuss. The production of baths has undergone a similar development. Although the capacity of the German bath foundries is capable of more than covering the country's requirements, a large German company and the American Sanitary Company have both erected new works capable of producing large outputs. The result is that the price of baths in Germany has fallen to a level at which the producers suffer a considerable loss.

In the other sections of trade and building foundry products business has been very dull throughout the whole year. All hopes of the usual seasonal activity proved deceptive. As there was but little building, sales suffered severely. The demand for stoves in particular showed a further decline. Owing to the exceptionally mild winter of 1929-30 the dealers were unable to clear their stocks, and even at the beginning of the season there was no demand necessitating their renewal. The result was that the stove foundries, which had somewhat increased their production in expectation of the seasonal activity, saw their own stocks constantly increasing, and, consequently, they were obliged to close down to a considerable extent in the second half of the year.

Many large foundries producing engineering castings had to stop work entirely or partially for weeks in the late autumn or the beginning of the winter. At the moment this movement is being still continued. In articles of daily use the demand has also continuously declined. The need for economy, which is felt everywhere in Germany owing to the great economic distress, has naturally the effect of causing household purchases which would otherwise have been considered necessary to be postponed as long as possible.

A tariff measure of the German State Railway, which increased the individual article freight rates for long distances, has operated very unfavourably on the foundries producing engineering castings in particular. Owing to the decreased demand, dealers have adopted the practice of taking their castings as individual articles instead of in wagon loads as formerly, with the result that the increase in the individual article tariff considerably increases the price of the article, the burden on the producer's costs being correspondingly increased.

Engineering Demand Unsatisfactory.

The position of the foundries producing engineering castings, whether working only for customers or in connection with an engineering shop, is dependent on the amount of orders in the hands of the engineering works, but throughout the year this has been unsatisfactory in all branches of the trade. Owing to the absorption capacity of consumers having been exceeded, combined with the tightness of money and the impossibility of foreseeing economic developments, undertakings everywhere covered only their most imperative requirements. German agriculture is absolutely incapable of making purchases, and works producing agricultural machinery and utensils are in a very bad way. The market for textiles is also bad all over the world; owing to the defection of Russia as a buyer, the troubles in China and India and the confusion in South America, these countries have ceased to be markets for both textile goods and textile machinery, and this reacts on those ironworks which supply the textile industry. The automobile industry, as to which there were at the beginning of the year hopes of greater activity, also restricted its production during the summer, either diminishing or entirely ceasing its orders.

The German locomotive engineering works are in an exceptionally depressed condition. Old-established firms of international repute have stopped building locomotives, while some of them have closed down their works altogether; others have effected amalgamations and are content to accept such orders as are not altogether outside their scope. The North German shipbuilding yards have secured contracts for several large vessels, and have consequently been able to give considerable orders to the foundries from which they obtain their supplies. Work in the electrical industry was comparatively active, but a falling-off in orders is now reported. In this particular field, moreover, the foundries have to meet a very keen competition from weldings, and this has considerably restricted their market.

Price-Cutting Evils.

It need hardly be mentioned that in these circumstances the few contracts that came on the market were very keenly contested, and gave occasion for very considerable price-cutting by the foundries. In such a situation each foundry is fighting not merely for the particular contract, but for its own existence. The desire to keep down fixed overhead costs by obtaining "filling-up" orders, and to retain capable workmen, who are scarce even in Germany, leads to offers being made in every department, with very little or no consideration being paid to actual costs. Many foundries are also apprehensive that, if once they are forced out of the field with their existing customers, they will remain out permanently, and they therefore endeavour by low quotations to retain consumers at all costs, in the hope of surmounting the crisis, knowing that otherwise they would be forced to succumb. In view of such considerations, instruction in rational costing by foundries and local or sectional amalgamations for price agreements are of no avail, and during the past year the laboriously constructed—or, at least, developing—"price edifice" of the German iron foundries has, in fact, been shaken to its foundations.

At the same time, the position of the ordinary foundries working for outside customers has been made specially difficult by the fact that they have had to face an unusual and unpleasant competition from foundries having their own engineering works, which were not sufficiently busy in supplying their own requirements, and therefore placed their products on the general market, as well as from many malleable-iron foundries which, for similar reasons, have rushed into the grey-cast-iron market and upset prices, in ignorance of the actual conditions, such competition being beyond the control of the German Ironfoundry Owners' Federation and its price agreements. The general recognition of the fact that the German level of prices, which is much too high compared with that in other countries, is one of the factors preventing an economic recovery, has led the Government to adopt measures for the reduction of prices in conjunction with a reduction of official salaries as well as of wages and salaries in private industries. This movement for the reduction of prices, which has dominated the entire economic life of the country during the latter half of the year, has now exercised its effect on the iron foundries by further depressing prices, the reduction having no justification in any corresponding lowering of costs. Under the German system of fixing wages legally, the process of wages reduction is carried out very slowly and subject to tedious arbitration proceedings, so that market prices—apart from advance reductions already made in certain branches of industry, including foundry work—can be lowered only gradually. The action of the Government has in the main, therefore, merely had the opposite effect to that intended, viz., the revival of industry. Consumers everywhere are holding back in the expectation of further price reductions, and it will be extremely difficult to overcome these obstacles even when the price-reduction movement has been further developed.

Prospects for 1931.

Taken as a whole, the position of the German iron foundries on entering the present year must be described as desperate. This position is faithfully reflected by the following figures. The number of workmen employed by the firms belonging to the Association of German Iron Foundries, which in normal times was about 100,000, and on January 1, 1930, was still 70,000, has now declined to some 50,000. Although this reduction is partly due to rationalisation measures, it nevertheless shows very clearly the shrinkage that has taken place in foundry work. Even more startling are the figures of failures and stoppages of work among foundries during the period of depression in 1929-30. Thirty-four foundries were obliged to make a judicial arrangement with their creditors for payment of a percentage of their debts, whilst 32 firms became bankrupt. Again, 99 firms wound up their businesses and closed down their foundries. Although these include a number of foundries which hope to be able to resume work when times improve, the stoppage will in many cases be permanent. The concerns which have either become bankrupt or have closed down voluntarily include a number of old and substantial foundries, some of which were of world repute.

The desperate condition of the German iron-foundries will cease only with the recovery of German industry as a whole, and this in turn is dependent on the cessation of the world economic crisis. If that is to be remedied, however, the root of the evil must be taken in hand, and that is the Reparations question, which has not been solved even by the new Plan. So long as a country is compelled to send milliards of marks abroad every year without any kind of return, the economic depression throughout the world will never be cured. The impoverishment of a country reduces its purchasing power in the world's market, and therefore injures its suppliers just as much as its competitors, whom it is obliged to undercut to obtain the necessary foreign bills for the payment of its debts.

John Surtees Memorial Competition.

The Newcastle Governors of the John Surtees Memorial Competition have received over 50 entries for the Junior Section of this competition, which is to be held at the end of this month. This remarkable number of entries is due to the commencement of classes for foundry apprentices which the Branch was instrumental in forming under the auspices of the Rutherford Technical College. The course at these classes covers four years, and includes theoretical and practical work. For the practical side, a completely-equipped small model foundry has been opened and is now operating three evenings each week. The boys are under the able tuition of Mr. F. W. Nicholson, a member of the Newcastle Branch.

The British Electrical and Allied Manufacturers' Association will be represented at the forthcoming British Empire Trade Exhibition at Buenos Aires by a composite exhibit designed to show the resources of the British electrical industry, and in addition a number of firms will show their individual work. For the benefit of the industry a pavilion with 1,200 sq. ft. of stand space has been taken, in which will be photographic illustrations, models and literature in Spanish dealing with some of the big electrical schemes that British manufacturers have carried through in different parts of the world. In at least 20 of the windows will be wash drawings of these schemes, including some which have been carried out in Argentina and other parts of South America. Mr. W. Watlington, chairman of the Council of the Association, who is also a member of the Grand Council of the Exhibition, will attend the Exhibition with other members of the Council.

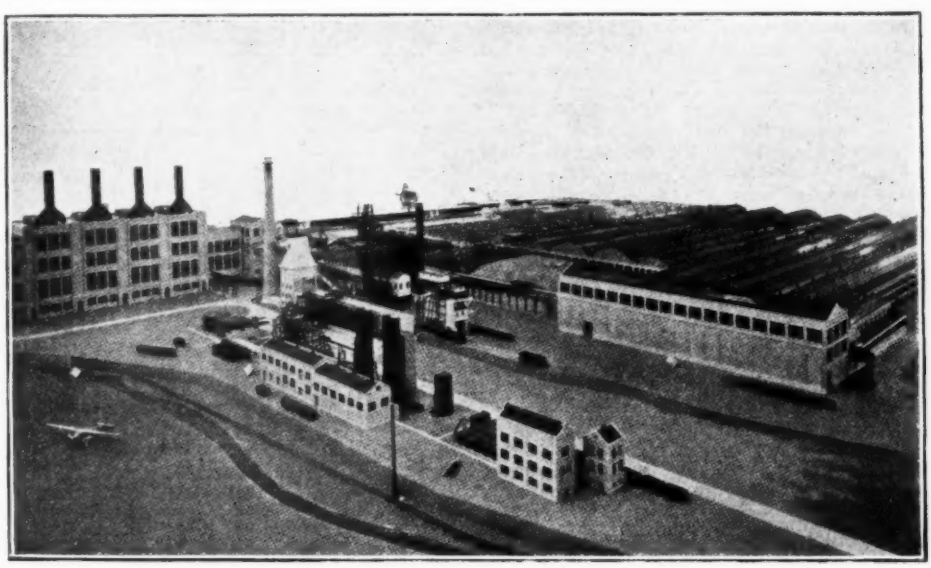
The New Ford Blast Furnace at Dagenham.*

By P. J. Hale.

Since February of last year steady progress has been made at Dagenham, on the construction of the blast-furnace section of the large industrial programme undertaken by the Ford Motor Company, Limited.

At this place, situated on the north bank of the Thames River and about twelve miles east of the City of London, the Ford Motor Company, Limited, has acquired, to date, a total of some five hundred acres, and it is on the southern portion of this area and along the river that the initial construction is taking place.

The units comprising this initial construction include manufacturing and assembly buildings, foundry buildings, power and boiler plant, coke-oven and by-products plant and blast-furnace plant. The latter includes one 500-ton furnace with double skip, three Schiffer-Strack hot-blast stoves, stock bins, Theisen disintegrator gas-cleaning plant, ore-storage yard, pig-casting machine, waste-water clarifier, sintering plant, together with the necessary gas, air, water and sewer mains. Serving the sintering plant, ore-storage yard, stock bins and foundry building will be a double-track high-line structure extending out and on to a reinforced-concrete wharf now being built in the river. On the wharf, or river end of this high-line structure, will operate two rapid unloaders which will discharge cargoes of ore, limestone, coal, etc., into two 50-ton transfer cars. These will travel the length of the high-line structure and discharge materials at the locations required. The ore-storage yard will be served by an 11-ton ore-stocking and reclaiming bridge travelling on bridge walls, 681 ft. long, and spanning storage piles, 190 ft. wide and 40 ft. high. The stock bins will be served by a 10-ton scale car. Skip hoist, ore bridge, ore unloaders, transfer cars, scale cars, pig-casting machine, and other units will be electrically operated.



VIEW OF A MODEL OF THE FORD WORKS WHICH ARE BEING CONSTRUCTED AT DAGENHAM.

Prior to its acquisition by the Ford Motor Company, Limited, a large portion of the site had some years ago been used as a dumping ground for materials excavated from London's underground railways, so that the present top layer comprises an artificial fill varying from 15 ft. to 20 ft. in thickness. Underlying this artificial fill, test borings indicated varying layers of river mud, peat, fine sand and, finally, a substantial stratum of closely-compacted gravel, locally known as "Thames Ballast."

This stratum of "Ballast" is encountered at depths of from 40 ft. to 45 ft. below the surface and borings indicate its thickness as varying from 12 ft. to 20 ft.

Piling was, therefore, indicated as being necessary to transfer all important foundation loads to this layer of ballast, the type of pile used being pre-cast reinforced concrete, 14 in. square and from 40 ft. to 50 ft. long. Their safe carrying capacity, as indicated by the final set of several test piles immediately after driving, has ranged between 45 and 55 tons. Later, actual loading test on one of the piles at the furnace foundation showed no settlement at 40 tons load, $\frac{1}{8}$ in. at 80 tons load and $\frac{3}{16}$ in. at 100 tons load. For purposes of foundation design at the blast-furnace plant, the load per pile has in general been kept between 40 and 45 tons.

The stoves, furnace and cast house required 778 piles, while the bridge walls required 1,264 piles. Piling for gas-cleaning system foundations has also started, and contracts are about to be placed for the necessary piling for the stock bins and pig-casting machine and other foundations.

After completion of the pile driving, the furnace foundation was completed in June and the stove foundations in July, 1930.

These foundations are of reinforced concrete and are, in general, similar to other Freyn-Design installations in America. Cellular design has been used for the double purpose of economy of concrete and decrease of foundation loads. This is further accomplished by placing the stove waste-gas flue directly in the foundation, where it passes under all stoves and at its end connects with the stove chimney.

In the construction of the skip pit, the use of a pneumatic caisson has been decided upon, dispensing with reinforced concrete piles and sinking the caisson down until its cutting edge reaches the Thames Ballast. After being cleaned out, the whole of the lower inside space of the caisson will be filled with concrete, the skip pit therefore resting directly on the top of the ballast. This use of a pneumatic caisson has been dictated by the desire to prevent any leakage or flow of water into the excavation, so that there may be no disturbance of the materials adjacent and underlying the foundations already in place.

Erection of the iron and steel work for furnace and stoves has closely followed the completion of their foundations, shop work on these items being scheduled well in advance of requirements in the field.

English procedure is being followed in the erection of the furnace and stove shells, in that the plating is practically fully erected before field riveting is started.

The engineering contract for the design and supervision of construction of the blast-furnace section was in 1929 placed by the Ford Motor Company, Limited, with Messrs. Ashmore, Benson, Pease & Company, Limited, of Stockton-on-Tees, who are the British associates of Freyn Engineering Company.

By virtue of this association, therefore, this firm has become sponsors of Freyn-Designs in Great Britain and her Dominions.

The firm has long been established as one of the leading British engineering and fabricating companies in the gas, chemical and iron and steel industries.

In April, 1930, this firm received an additional contract from the Ford Motor Company, Limited, for the fabrication and erection of iron and steel work for furnace, stoves, stove chimney, skip incline and gas-cleaning system, followed shortly by another covering structural steel and brick work for the cast house.

Freyn-Design specialities which Messrs. Ashmore, Benson, Pease & Company are supplying for Dagenham, include blast-furnace charging control system, automatic water control, coke-weighing control, continuous stock-line recorder, pressure burners for hot-blast stoves, gas precooler, chimney valves and hot-blast valves. The stock bins will be equipped with the Freyn-Design double-lipped air-operated bin-gates. The hot-blast stoves will be lined with the high efficiency type Schiffer-Strack chequer brick. The blast-furnace gas will be cleaned by Theisen disintegrator gas washers.

In view of the fact that the new furnace will be the most modern and of the largest productive capacity in England, its progress is being interestedly watched by the iron and steel industry of Great Britain.

* Extracted from "Freyn Design," a publication issued by the Freyn Engineering Company, of Chicago, Ill., U.S.A.

Steel-Foundry Research.

The Battelle Memorial Institute at Columbus, Ohio, U.S.A., announces the establishment at the Institute of a research project sponsored by the Ohio Steel Foundry Company of Lima and Springfield, Ohio. This research project will consist of a comprehensive study of steel-foundry practice with a view to developing improvements and economies in practice as well as the betterment of finished products. Dr. C. H. Lorig, a member of the Institute staff and a specialist in foundry practice, will be in immediate charge of this work, under the direction of Mr. Clyde E. Williams, assistant director.

Japanese Steel for China.—According to a report received recently from Japan, a contract has been signed between the Yawata Steel Works and the Japanese Mitsui Bussan Kaisha for the regular export of the former's steel products to Tsingtau and Tientsin through the latter. The contract is for six months commencing January/February shipment, 1931, the amount being 1,200 to 2,400 metric tons per month. Negotiations are going on between the same parties for exporting the goods to Shanghai. As the Mitsubishi Trading Company recently concluded a similar contract with Yawata, these contracts seem to involve nearly all the most important ports of China.

Rapid Open-Hearth Furnaces.

By PROF. N. E. SKAREDOFF, M.E. (of Yokohama).

Reviewing the new developments in the principal steel plants of the world, one may notice that the outstanding feature of the last decade is the general tendency to increase the capacity of open-hearth furnaces. The reasons for this are evident. The big furnace gives more steel for the same number of workmen; a small number of big furnaces means economy in fuel, etc. Such a method, however, has its drawbacks. High-capacity furnaces are very expensive, and for such big furnaces very heavy cranes and stronger craneways are required, which implies an almost complete reconstruction of the building, etc. All that is very expensive. Also, with a small number of high-capacity furnaces, furnaces which give usually two charges daily each, the delivery of ingots to the rolling mills often becomes very irregular. Sometimes two or three tappings follow each other at short intervals. Soaking pits or reheating furnaces in the rolling mills must be provided to meet the maximum delivery of ingots, not the average, and when such surplus furnaces or pits stand idle, it means extra fuel, labour, etc., expense. Such are some of the advantages and disadvantages of very big furnaces.

There is, however, another way of increasing output, cutting down expenses for fuel, labour, general expense, etc., without the drawbacks of high-capacity furnaces—erecting rapid-working open-hearth furnaces of the same size as are in use at present in any steel plant contemplating radical improvements. Rapid open-hearth furnaces, as the name implies, are open-hearth furnaces which produce steel in much shorter time than ordinary furnaces now in use. With these furnaces, instead of the usual two or three charges daily, it is possible to get five to six charges from each daily, whatever the capacity of the furnace. That is, without increasing the number of furnaces or enlarging the plant or increasing the number of workmen, the production of the plant can be doubled.

These furnaces are the invention of the author (late professor at the Far Eastern University), and the first furnaces of this type have been built in Japan, whither the author emigrated after the Russian revolution. The furnaces described were built under his direction and supervision at Kamaishi Steel Works, Japan, and all the data following have been taken from the records of that plant. The erection of the first rapid open-hearth furnace at Kamaishi was completed in June, 1927. In the first campaigns, due to the weakness of the refractory materials and other local conditions, full speed could not be attained, but after six months of training the workmen, the difficulties were overcome and the furnace began to give a speed approaching that intended by the inventor—about five charges every day. The time for one charge was between four and five hours, but many charges were finished in as short a time as 3 hrs. and 35 min., and there were days when six charges were tapped.

In the second half of this first year, 1927, the furnace gave 1,538 charges, or 12,000 tons of ingots. The capacity of the furnace is 25 tons, and the charge consists of 20 to 30 per cent. of molten pig from the blast furnace direct (foundry pig with 2 per cent. of Si and 0.4 per cent. P), 20 to 30 per cent. of cold pig and 35 to 50 per cent. of steel scrap. The fuel is coke-oven gas and coal tar. The consumption of fuel was about 50 kgs. of tar and 200 cub. m. of gas, which corresponds to 1,200,000 calories per ton of ingots. In English units that corresponds to:—Coal tar 10.3 galls. and 7,063 cub. ft. of gas or 4,760,000 B.T.U. per ton of ingots. The working results of this furnace in the two following years were:—In 1928, 1,195 charges with 28,000 tons of ingots; in 1929, 1,146 charges with 26,300 tons of ingots.

Encouraged by the success of this first rapid open-hearth furnace, the Kamaishi Works erected a second furnace of this type, with some further improvements worked out by the inventor, which started working in May, 1930. In October of the same year the new double-charge rapid process was developed. In this process double the amount of an ordinary charge (in this case 50 tons instead of 25) are charged. In common furnaces such a charge would require double time and there would be no gain, but the rapid principle enables the furnace to finish this double charge in much shorter time than would be required if this weight of metal were charged as two separate charges. At first, three charges only were tapped daily, which, however, corresponds to six normal charges, but after some time four charges daily were obtained, which gives as much metal as eight ordinary tappings.

The contents of the charges varied between:—Steel scrap, 15 to 20 tons; liquid pig, 15 to 20 tons; cold pig, 5 to 15 tons; lime, 3 to 4 tons; iron ores, 7 to 8 tons. The fuel consumption for such charges was between 45 to 50 kgs. of tar and 160 to 180 cub. m. of coke-oven gas per ton of ingots, a total of 940,000 to 1,100,000 calories per ton; or, in British units, 9.3 to 10.3 galls. of tar and 5,600 to 6,400 cub. ft. of coke-oven gas, a total of 4,120,000 B.T.U. per ton of ingots. Converting this heat into coal, with 7,000 calories per kg. or 12,600 B.T.U. per lb., we get the coal consumption as about 15 per cent., or about 330 lbs. per ton, only. The author hopes that with some improvements in the local conditions five double charges, equal to ten normal charges, per day can be attained without difficulty.

As the steel plant at Kamaishi has only 25-ton ladles and 40-ton cranes, the 50-ton charge is tapped by means of a bifurcated spout into two ladles and the metal teemed into the moulds as usual. The metal produced is low-carbon soft steel (C = 0.09 to 0.15) for round bars, rivets, small angles, etc. No high-carbon steel was produced, but with high-carbon steel greater speed could be developed, because the metal is sufficiently hot for tapping very soon after the charge is melted down, and the most part of the refining time is used for reducing the carbon contents.

It is evident that this rapid furnace is working under much more difficult conditions than the famous furnace at Terni, which uses 20 to 27 per cent. of basic pig in the charge and produces steel with a carbon content as high as 0.4 to 0.6 per cent. This cannot be compared with starting with 50 to 60 per cent. of foundry pig and finishing with carbon 0.09 to 0.12 per cent., and, in spite of these handicaps, the results are better.

Comparing with other furnaces of common type at the same steel plant at Kamaishi, it is noteworthy that their average annual output per furnace was 750 charges, and the weight of ingots produced 16,000 tons. The conditions of work as regards nature of charges, steel produced, quality of bricks, etc., were identical with those of the rapid furnaces. The normal fuel consumption for these ordinary furnaces was about 35 per cent. of coal per ton of ingots. All these figures prove that the rapid open-hearth furnace can do good service in steel plants, enabling them to double their output with the same number of furnaces, with the same equipment, and much reduced fuel and labour costs.

Melchett Medal.—The Melchett Medal awarded by the Institute of Fuel is to be presented to Dr. Kurt Rummel, of Wärmestelle, Düsseldorf, to-morrow. The medal was instituted by the late Lord Melchett, founder-president of the Institute, who a few months before his death offered a sufficient sum to found the medal in perpetuity. It will be presented annually to any person who has done research or work of an outstanding character involving the scientific preparation for use of fuel.

China's Iron Industry.

DR. KARL WENDT, of Essen, introduces an article published in "Stahl und Eisen" with the remark that China is one of the oldest iron-producing countries; her industry began many centuries before the Christian era. There still exist in that country many of the original small iron-smelting plants, as a rule situated where both coal and ore are available on the spot. The iron is used for making vessels for the temples, cart-tyres, ploughshares and many other objects in common use. These small smelters still produce some 180,000 tons of iron per annum, a rather remarkable tonnage, which until about 70 years ago was quite sufficient to cover China's whole consumption. It was not until the end of the eighties of last century that iron products began to be imported at the annual rate of some 6,000 to 7,000 tons; rising to 70,000 tons by 1890, and now totalling 700,000 tons per annum.

Iron production by modern methods was only introduced about 40 years ago in China, when the well-known Viceroy, Chang-Chi-Tung, took it upon himself, in 1890, to establish a large iron and steel plant in the country itself, the original purpose of which was to supply the necessary equipment for the projected Hankow-Canton railway line, in which there is still an unbuilt gap of some 270 km. Later on the plant was to supply the country's other requirements and make China independent of imports. The site selected for the Viceroy's scheme was at the confluence of the rivers Han and Yangtse, opposite Hankow, in the industrial centre of the country, and the works established there are the well-known Han-Yang Iron & Steel Works. For a long time these works were the only ones of their kind established in China.

TABLE I.—*Blast Furnaces in China.*

Place.	Owners.	No. and size of furnaces.	Annual output capacity.
		Tons.	Tons.
Han-Yang ..	Han-Yeh-Ping Co.	2 of 75 2 „ 250	230,000
Ta-Yeh ..	Han-Yeh-Ping Co.	2 „ 400	280,000
Hankow ..	Yangtse Engng. Works	1 „ 100	36,000
Penchihu ..	Penchihu Co.	2 „ 20 2 „ 140	115,000
Anshan ..	S. Manchuria Rly.	2 „ 250 1 „ 500	360,000
Peking ..	Lung-Yen Co.	1 „ 250	90,000
Pootung ..	Wou-Ching Co.	1 „ 12 1 „ 33	16,000
		Total ..	1,127,000

The number and locations of the blast furnaces existing to-day in China are shown in Table I, with the names of the respective concerns owning them and their annual output capacities. All these plants are laid out on modern lines, but their output capacity, aggregating over 1¼ million tons, is only utilised at the rate of 25 to 30 per cent. If Japan for political considerations had not kept its two plants at Penchihu and Anshan going, notwithstanding their high working costs and the large interest charges on the invested capital, even the above low percentage of the total output capacity would not be reached, as there is not a single furnace blowing in the whole country except those at the two above-named plants, under Japanese management.

Besides the blast furnaces, only a few open-hearth furnaces have been erected in the country, namely, seven of 30 tons each at Han-Yang and two of 15 tons each at Wou-Ching, but not one of these is now working. In some of the arsenals a couple of small open-hearth and electric furnaces are working for supplying the works' own requirements. No rolled iron and steel at all is produced in China.

The Magnetic Treatment of Moulding Sands.*

By W. E. Box.

The question of the general treatment of *used* foundry sand is of importance to all foundrymen, because, up to the present time, the problem does not appear to have been treated with the consideration which it deserves, and yet this is rather remarkable in view of the fact that the condition and constitution of moulding sand is one of the prime factors governing the quality of castings produced.

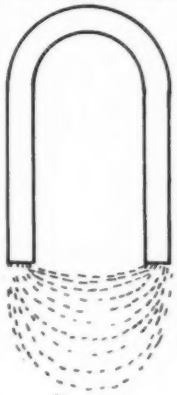


FIG. 1.

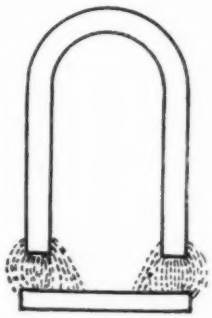


FIG. 2.

For obviously economic reasons practically all foundries endeavour to use the maximum amount of old sand to which a sufficient amount of new is added for reconditioning purposes.

Unfortunately the old sand contains scrap metal in the form of core irons, gits, splashings, brads, peas and the like, and in the majority of

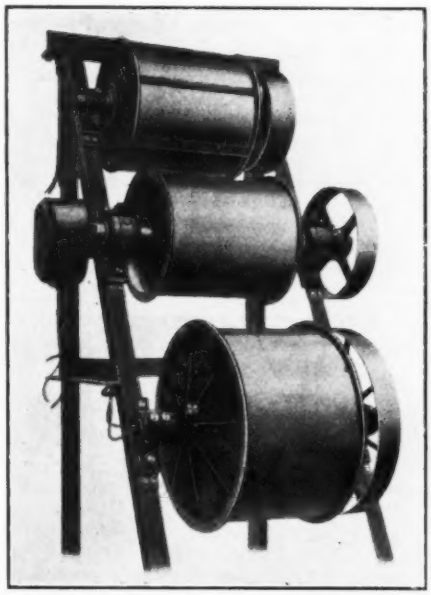


FIG. 3.—THREE TYPES OF ROTARY SEPARATORS.

cases, in order to get rid of these, mechanical sifting is resorted to, whereas in not a small number of cases men paid as moulders individually carry out the preparation of sand by hand, with the aid of a ½-in. or ⅜-in. mesh riddle.

A considerable amount of trouble experienced throughout foundry practice to-day can be undoubtedly traced to the presence in moulding sand of these small pieces of metal such as the small splashings in the form of peas and brads; in fact, all such metal which passes through the mechanical or hand-operated sieves, and it is contended that magnetic separation, if correctly applied, is the most dependable, efficient and cheapest method of overcoming this trouble.

Factors in Choosing a Magnetic Separator.

First of all, it is interesting to note that one firm makes four or five different types, each of which can be applied in various ways depending upon the conditions, but apart from this, unusual precautions must be taken, as magnetic separators are not so widely known as, say, electric motors.

The magnetic separator must be of sufficient size to deal with the peak-load capacity if it is to be of any use at all. The construction must be such that it can be guaranteed robust enough to withstand the adverse conditions met with in foundries—easy access provided for speedy adjustment, lubrication, repair or replacement, and although simple in design, it should take up a minimum amount of space and consist also of a minimum number of working parts.

Magnetic separators extract the large and small pieces of ferrous metal. The small pieces would pass through sifters, and the extra value of metal thus retrieved alone soon pays for its application, apart from the labour it saves. By extracting this iron the used sand is purified, rendering it possible safely to re-use a larger quantity than hitherto, the stoppages due to damage to mills, mixers, aerators, disintegrators and mechanical distributors are avoided to a considerable extent, the life of patterns increased and the quality of castings improved.

Apart from these facts, it must not be forgotten that milling is quicker and more efficient if there is not iron to be dealt with, and last but not least, by taking the iron out before sifting, it prevents clogging up and excess wear of same.

It is now an established fact that there are many advantages in favour of the application of magnetic separators, and by studying the performance of various types actually operating under foundry conditions, it is of the utmost importance to note that the efficiency of magnetic separation and sifting rapidly decreases as the percentage of moisture content increases—in other words, the sand is most suitable for treatment in the dry state, as obtained from the moulds when the castings are knocked out; furthermore, this facilitates a greater consistency in tempering at the mixing stage, which is much more easily controlled when the moisture content is low and within such reasonable limits.

Against the question of handling dry sand in this manner, and where managements are desirous of improving the general working conditions, it will be found necessary totally to enclose all equipment handling this dry material as a prevention against the atmosphere being dust-laden. Fortunately, however, the great advantages obtained by treatment in the dry state warrant the small extra cost which would be involved.

Regulated Feed Essential.

The design and construction of magnetic separators have vastly improved lately, and a big mistake made in the past, which was that of not taking the question of feed into account, has now been overcome to a considerable extent by the use of jig feeders, having means for regulating depth and speed of flow in the vicinity of the magnetic field.

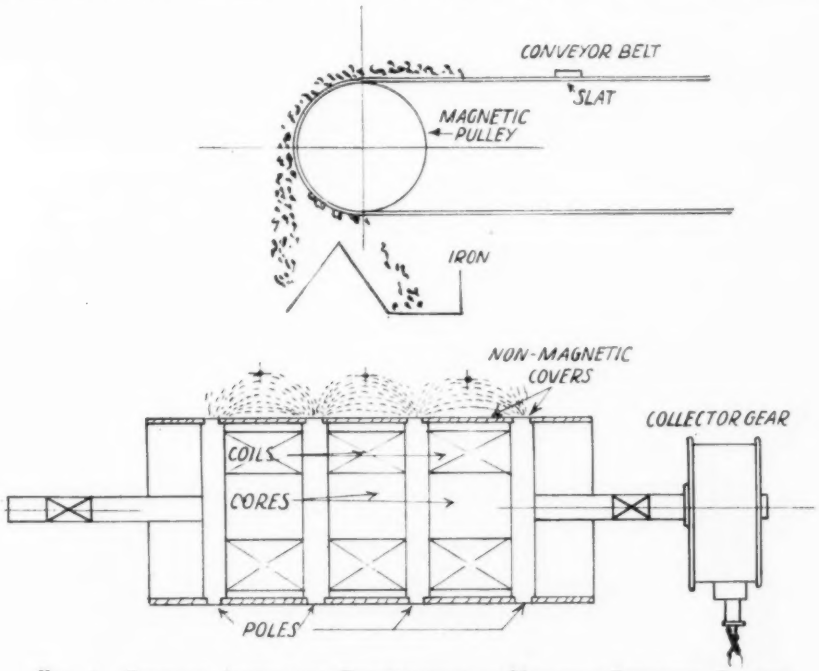


FIG. 4.—SHOWING ACTION AND CONSTRUCTION OF MAGNETIC SEPARATOR PULLEY.

Experience now proves that this question of regulated feed is essential, as it determines the duration of time during which any ferrous metal is influenced magnetically, and this in turn determines naturally the efficiency of extraction. In other words, by keeping the depth of feed and speed of travel to predetermined limits, the separator has a greater chance to extract the foreign metal.

It must be remembered that it is much easier to extract large pieces of iron than small pieces, but at the same time it is necessary to extract even the smalls if quality of sand and finished castings is the aim as distinct from applications purely for the extraction of the metal from foundry waste prior to dumping, ostensibly for its value.

When feeds are so regulated it is easier also to design any given-size separator to produce much stronger pulls, because the fields can be concentrated within reasonable depths, and, after

* A Paper presented to the Birmingham, Coventry and West Midlands Branch of the Institute of British Foundrymen, Mr. D. Wilkinson (Branch-President) presiding.

all, the strength and arrangement of the magnetic field is the crux of the process.

Magnetic separators are a commercial proposition if applied separately, and can be obtained in a range of sizes to treat 1 up to 100 tons per hour, but it is worth while to consider improvements in handling methods, cutting down labour charges, in conjunction with such installations, whether in a complete new plant or just an addition to plant already existing.

The saving resulting by the installation of a small or large equipment in the portable form,

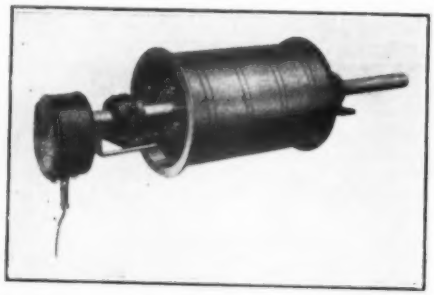


Fig. 5.—Showing Magnetic Pulley.

or suitable for fixing in a corner or centralised position in the foundry, soon pays for itself, and, generally speaking, the resultant space saved, is better utilised for production by the labour it releases.

No Standard Applies.

It is impossible to lay down details or arrangement of such an equipment to suit all iron and steel foundries, because, naturally, the production capacity, class of sand and castings made and other local conditions, such as present labour costs and existing plant, considerably affects the question. In some cases, where small quantities of facing sand are required, a magnetic separator alone meets the needs. In other cases, sifters, band conveyors, bucket elevators and such other handling contrivances are necessary, especially where large quantities have to be dealt with.

Where magnetic separation is desirable for the treatment of sand to be used as backing sand, or for dealing with foundry refuse for purification or as general salvage respectively, it is possible actually to handle this material cheaper than many present cases for just dumping this material, and valuable iron is saved. Further advantages and considerable saving are facilitated when it is possible to re-use the sand, as then the separation process can be combined with such sifters, crushers and the like without extra labour.

Sand Crushing.

In some cases a rough method of crushing is employed to release metal in the form of core irons locked inside hard-baked core sand. This releases more sand for re-use and also reduces the space and labour required for dumping. If magnetic separation is not employed prior to sifting, and the material so treated is wet, trouble will be experienced due to clogging up of sieves with brads, etc., and the damp sand. Crushing, however, is a controversial subject!

In any case, sand cannot be used over and over again, and it is doubtful if there is a small crusher available of sufficient reliability at present, capable of dealing with metal hidden in caked sand, the shape and size of which is not detectable. When this problem can be left to a suitable small crusher with certainty, it will be the means of further increasing the efficiency of separation, and sifters applied, consequently, will salve a greater amount of good sand.

On the other hand, although crushers at present available are fitted with safety devices against breakages, in the form of compensating-spring loaders, shear bolts and the like, one unseen piece of metal, inadvertently passed on for treatment, causes repair costs and loss of time, due to damage to shafts, broken rolls, beaters or jaws. One way of dealing with this problem would be to rough-mill by means of a cheap robustly-constructed pan mill, having a continuous feed and discharge. This type, however, is not available, as far as the author is aware, and in any case, excepting in special foundries where large quantities would have to be dealt with, the initial running cost and space taken up by such a device would not warrant the application.

Another, and probably the best, way to overcome this trouble, since a certain amount of old sand has to be replaced by new to recondition it, is to fix a limiting grid, say 4 in. by 1½ in. section over the magnetic-separator feed-hopper, or at the boot end of the elevator feeding it, so that such large and undesirable pieces of core sand, metal and other foreign matter is prevented from going forward. If such material is a small proportion of the bulk, which is generally the case, then it is best dealt with separately, by the man attending the plant, by hand. This latter method has generally been adopted in recent plants, and appears to overcome the troubles hitherto met with.

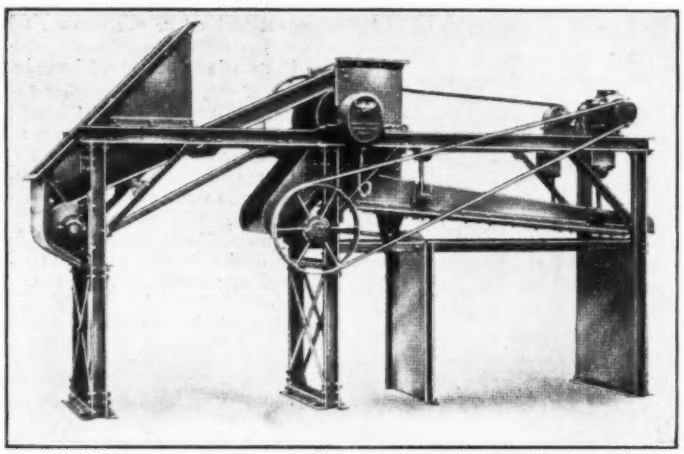


Fig. 7.—Small Separating and Sifting Equipment, for Use in Jobbing Foundries.

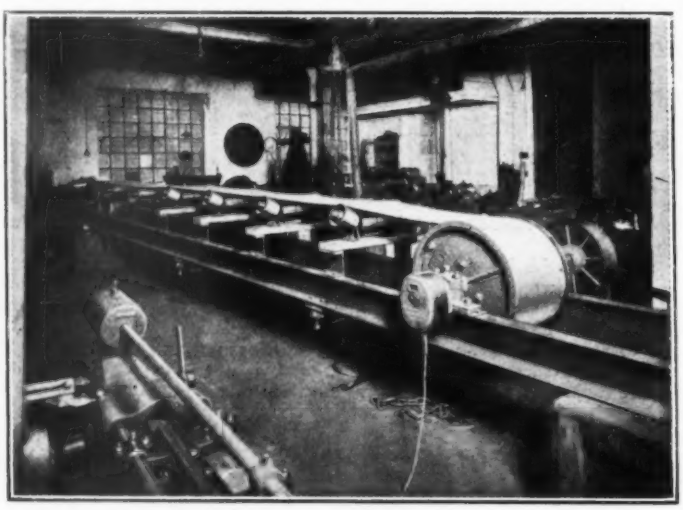


Fig. 6.—Magnetic Pulley working in Conjunction with Band Conveyor to separate Scrap from Used Sand.

Underlying Principles.

Fig. 1 shows an ordinary permanent magnet, which, by means of dotted lines, indicated the relative strength and disposition of the magnetic field emanating from the poles, whilst Fig. 2 enables one to see how the magnetic field is concentrated, due to the presence of an iron bar in close proximity to the poles, which actually increases the pull due to the decrease in the air gap.

These are shown because they have an important bearing on the internal construction of magnetic separators, designed to deal with used foundry sand, especially where it is essential to create a localised highly-intensified magnetic field capable of extracting the small particles referred to previously.

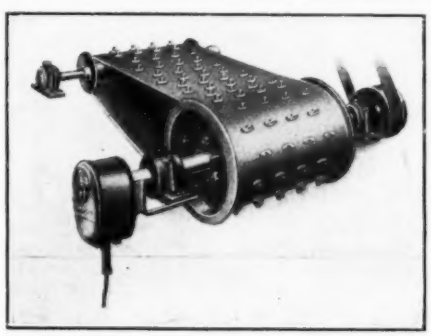


Fig. 8.—Magnetic Separator with Endless Band Conveyor fitted with Feelers.

Fig. 3 shows three different types of rotary separators, which, by the way, are mounted on a stand for photographic purposes only. The one at the top is a drum of special construction

for tramping purposes only, and is recommended for treating foundry waste, prior to dumping, purely for extracting the iron for its value. This application cuts out present hand sifting. It does not, however, extract the small iron, for reasons to be explained later.

The bottom one is another type of drum designed for similar applications, by means of

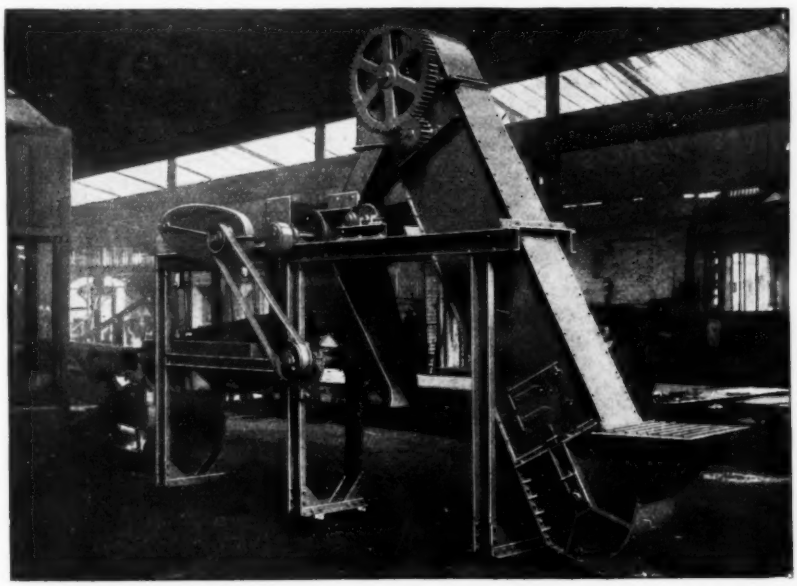


FIG. 9.—COMBINED PLANT, CONSISTING OF TOTALLY-ENCLOSED BUCKET ELEVATOR, MAGNETIC SEPARATOR AND JIG SIFTER.

which practically all iron, large and small, is not only extracted for its value, but also to purify the sand which will later be re-used. The centre example is a magnetic pulley utilised for tramping purposes. It is not suitable for extracting small pieces of metal, but has advantages, where band conveyors are adopted, for transporting sand from one position to another.

Magnetic Separator Pullies.

Fig. 4 is a sketch made specially to describe the construction and details of applications. It will be observed, on reference to the lower view, that the construction consists chiefly of circular castings, having centralised bosses forming cores, in which the magnetism is generated by the current passing through the coils. On the size and number of such castings and coils depends the width of band for which the pulley is required, and, as the coils revolve with the pulley, an insulated slip-ring gear and collector fingers are fitted to the shaft extension outside one of the bearings. As a protection to the coils, machined non-magnetic metal castings are clamped between each pair of machined poles to prevent loss of magnetism, and end covers are fitted to the outside poles made of similar material.

The poles are keyed to the shaft, and the coils are best wound on insulated machined metal formers, located by dowels to the inside face of the poles to prevent radial movement which would shear the cable leads. For efficiency the pulley gives the best results when revolving at a speed of 30 to 35 r.p.m. irrespective of the diameter. As these pulleys are slow moving it is desirable to crown the faces to keep the band or belt in a centralised position; whilst the non-magnetic end covers or extension pieces are to prevent pieces of iron lying on the edge of the belt, from curling under the belt and causing damage to the latter by continually revolving round and round.

This type of pulley is suitable for replacing the terminal head pulley of band conveyors and is mounted on suitable bearings; the shaft opposite the collector-gear end is generally extended and keywayed as a means for driving. It produces a magnetic field of variable strength over its face parallel to the direction of feed of the material, and whilst it is suitable for taking out the large iron from material under treatment, it certainly does not take out a great percentage of the small spillings under say $\frac{1}{8}$ in. dia.

The reason for this is that the strength is greatest in the vicinity of the poles where the concentrated magnetic field emanates; on the other hand, the outside poles and the centralised spots between the poles are weak, whilst at points as indicated by the crosses on the bottom view, there is a neutral position where ferrous metal is not affected by pull. This stipulation is made because there is a definite pull in this position, but the pull given by one pole is equalised by that given by the other, and the resultant pull unfortunately is not amenable to magnetic extraction.

The efficiency of a pulley of this construction is also reduced by the rubber band, but only on account of the extra distance this carries the material away from the field, as magnetism cannot be insulated in the same way as electricity itself. The pull on any magnet varies in inverse proportion to the square of the distance between, say, the pole of a magnet and the armature it is attracting, and is also proportional to B^2A, B^2 being the magnetic density, say, per sq. cm., and A being the amperes passing through the coil. It therefore follows that the thicker the band conveyor and the deeper the feed, the less efficient this type of pulley will be, but as the current in amperes is increased, which, in turn, proportionately increases the flux, an increase will be obtained in the magnetic pull.

The upper view shows the action of a magnetic separator pulley and is self-explanatory. In some cases, however, spherical and round-shaped material is liable continually to roll at the point where the band at the bottom leaves the face of the pulley. In order to ensure a definite discharge, a cotton slat is advisably stitched across the belt as shown which will prevent this trouble and wear on the belt.

Fig. 5 is an illustration of a magnetic pulley as just described. In this case, flanged non-magnetic end-covers have been fitted to prevent the lateral travel of the belt across the flat face of the pulley, and at the same time this method prevents scrap which may be lying on the edge of the belt, curling by magnetic influence between the pole and underside of belt, and causing damage to the same by continually travelling round and round.

Fig. 6 shows a magnetic pulley as just described fitted at the head of a band conveyor, which is used for magnetically separating scrap from used sand whilst conveying it from one place to another. The top troughed idlers prevent spillage, and the weight of the belt is taken underneath by flat-faced idlers suitably spaced, whilst the belt tension is provided for at the back idler position.

Separating and Sifting Plant.

Fig. 7 shows a small separating and sifting equipment designed to meet the requirements chiefly of small jobbing foundries. It consists of a hopper, an inclined band conveyor with magnetic pulley fitted at the head, and the framework so constructed to house a jig-shaker sifter. This equipment, complete with motor and necessary drives, is a self-contained unit capable of dealing with 1 to 3 tons per hour. It is suitable for mounting on a bedplate if it is found an advantage to move it by means of a crane from place to place.

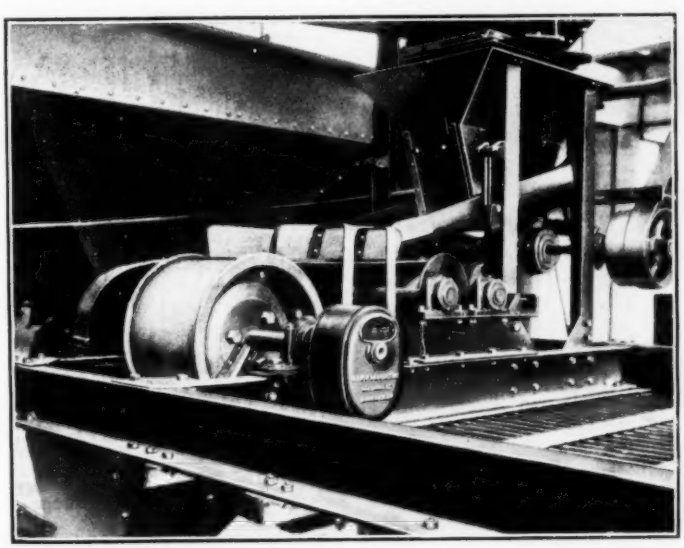


FIG. 10.—HOPPER WITH ADJUSTABLE GATE FEEDING BAND CONVEYOR.

Used sand fed into the hopper falls on to the top face of the band in an even stream, regulated by means of an adjustable shutter. The scrap extracted is discharged automatically down the back shute into a barrow. The rest of the

material falls on to a sifter unit suspended on machined brackets and pins, which is jig-shaken by means of an eccentric in a to-and-fro motion; the sand passing through the sifter falls into a barrow or jubilee wagon and, when reconditioned with a proportion of new sand and tempered, is fit for re-use. Oversize foreign material, consisting of char and the like, is discharged into a barrow at the end, and can be taken direct to the tip.

This plant, capable of dealing with 3 tons per hr., wound for existing direct-current supply circuit and complete with motor, costs less than 1d. per ton for treatment, which figure includes the electrical and mechanical power absorbed.

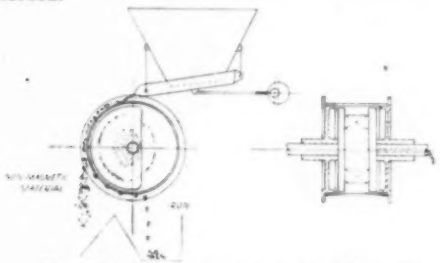


Fig. 11.—Magnetic Separator Drum in which a Steel-Flanged Cylinder revolves about Magnetic Unit.

Band Conveyors Incorporated.

Fig. 8 shows a magnetic pulley with short band conveyor and back idler. The endless short band is specially fitted with feelers as a means of improving the efficiency of extraction, particularly in respect of the small pieces of metal contained in the sand.

These feelers actually comb through the material under treatment, and when in the vicinity of the magnetic field become magnets in themselves by induction. This type of band, however, becomes too heavy when conveying a greater distance than, say, 3 ft., and on account also of the feelers underneath fouling any idlers placed to take the weight of the return strand, the application is limited really as a self-contained unit and not as a combined conveyor and separator.

Attention is drawn to the wrought-iron brackets fixed to the totally-enclosed collector gear to prevent rotation of this item.

Fig. 9 indicates the application of a short band conveyor as last described, in a combined plant consisting of totally-enclosed bucket elevator, magnetic separator and jig sifter. The sand is dry when dealt with, and it will be observed that the feed to the boot is fitted with a limiting grid to prevent large pieces of material from entering the buckets.

The sand, after passing through this, is elevated and discharged on to the band fitted with feelers; the iron is extracted and shot down the central shute, whereas the sand, now free of scrap, passes over the sifter, discharging separately into suitable conveyances the sieved sand for re-use and the foreign material as oversize for the tip. This type of plant deals with 4 to 6 tons per hr. and sieves and separates at less than 1d. per ton.

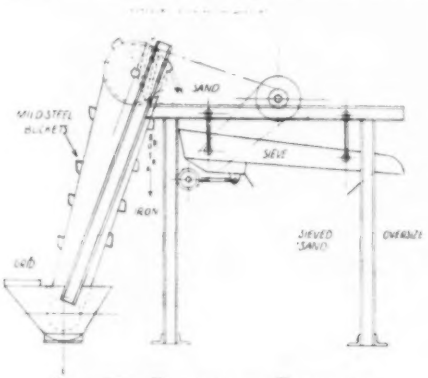


Fig. 13.—Diagram of Plant for dealing with 5 to 6 tons of Used Foundry Sand per Hour.

Fig. 10 shows a short band conveyor with hopper having an adjustable gate for regulating the feed. The illustration clearly shows the eccentric jig-shaker feed-tray belt-tension device for idler pulley, and splash boards to prevent spilling; also it will be noted that the bearings, eccentric, pulley and collector gear are totally enclosed and dustproof. The insulated leads from the coils are protected against damage by carrying them through a hollow shaft to the collector gear, which is the usual practice. This type can be obtained to deal with up to any capacity required by foundries by increasing the width of the belt and pulley.

Fig. 11 is a diagrammatic view of another type of magnetic separator drum consisting of a half-moon-shaped magnet unit around which a steel-flanged cylinder revolves. It will be seen that the magnet unit magnetises the front half of the drum only, and, being a fixture, a collector gear is not now required, as the current is fed to the windings through a hollow shaft. It is not necessary to have a band as a means for discharging the scrap because this automatically takes place where the steel cover leaves the poles of the magnet at the bottom of the drum.

The magnetic field emanating from the face of this drum is very similar to the pulleys previously described, but it is a type suitable for fitting in existing plants where space is confined. The drums are totally enclosed and revolve at a speed of approximately 20 to 30 r.p.m., whilst capacity is governed by the width and diameter of the drum installed. Feed by jig shakers, with means for regulating the flow on to the magnet, is again an aid to efficiency, and such a separator will extract large scrap but only a small proportion of the small metal.

As the insulated windings in this case do not revolve, such are former wound to fit the special shape of the core, which, when clamped between the poles, prevents radial movement. It will be noted, therefore, that this type is suitable for treating foundry refuse prior to dumping, and any sand used again would only be of reasonable quality for backing sand after riddling, because the defects of neutral zones exist with this type and a proportion of small metal is left in the sand.

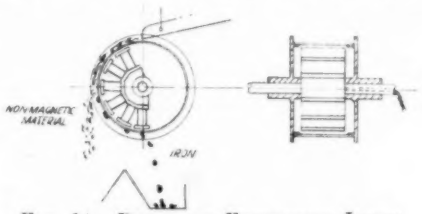


Fig. 14.—Drum for Extracting Large and Small Pieces of Metal Scrap from Used Sand.

Metal-Reclaiming Plant.

Fig. 12 shows a small plant embodying one of the latter-described drums applied purely and simply for treating foundry refuse as a means for preventing valuable metal going to the dump. The boot of the elevator is fitted with a hopper grid, the grid being flush with the floor, enabling a barrow load to be tipped into it if necessary. The sand, in order to allay dust, is watered a little, which renders it necessary to fit the discharge shute of the elevator with a jig-shaker motion which regulates the feed and also prevents clogging up.

Underneath the separator can be seen the diverting shutes down which the scrap and sand are separately shot into receptacles. This plant is fitted with a.c. motor having sufficient power to drive the plant and also a d.c. generator supplying d.c. current for the separator. The cost of the complete plant dealing with 4 to 5 tons per hr. electrically and mechanically to treat the refuse is approximately 1d. per hour. It must also be realised that a quantity of labour to hand-sift this material to salve the metal content can be released for production.

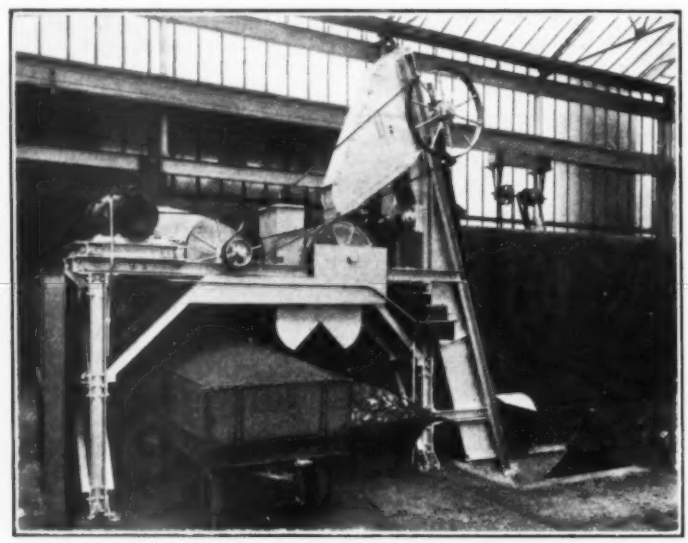


Fig. 12.—Plant for Reclaiming Metal from Foundry Refuse.

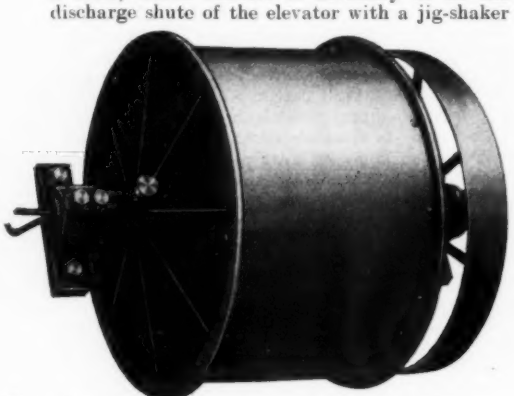


Fig. 15.—Drum similar to that shown in Fig. 14 fitted with Flanged End Covers.

Fig. 13 is of very special interest, as it gives for the first time an opportunity of inspecting the principles and application of a recently-patented drum. The results of tests recently carried out, and the wide range of uses to which it can be applied, make it of general interest. The internal construction and method of winding this new type of drum is such that it will magnetise and hold magnetic scrap, large or small, contained in a standard steel bucket

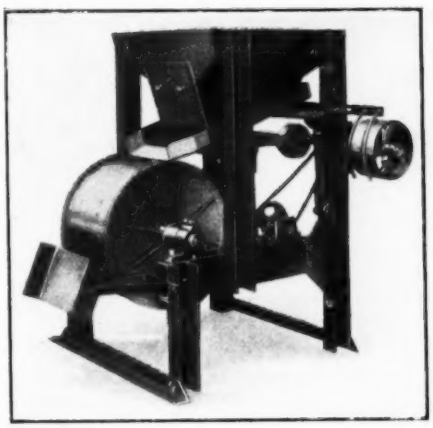


FIG. 16.—PLANT EMBODYING DRUM SHOWN IN FIG. 15.

whilst passing over the magnetised drum. The portion of the drum always magnetised is indicated on this diagrammatic view by shading.

During tests a 16-in. dia. magnetic drum consuming a current of 1.26 amps. on 220 volts was sufficient to extract a piece of iron weighing over 7 lbs., which represents the maximum size an 8-in. bucket would elevate. A further test proved it highly satisfactory for extracting small shot and filings when mixed with sand.

This separator consists of a steel-clad drum revolving round the special stationary magnet unit, and the size, relative to diameter and width, determines the capacity. The small plant illustrated is self-explanatory and is capable of dealing with 5 to 6 tons of used foundry sand per hour, and combines one of these bucket-elevator separators with a jig sifter.

Where a belt drive and d.c. current is available the cost for this equipment suitable for extracting the large and small iron, the total cost of retrieving sieved sand for re-use and discharging these two products, as well as the oversize material, direct into barrows or the like, is between ½d. and 1d. per ton. The separator elevator can, of course, be made as a portable equipment, with or without sifters, for treating dump sand, or for handling in various parts of the foundry. The applications are numerous, but the examples given need not be enlarged upon.

Fig. 14 shows a drum which is undoubtedly the only type capable of extracting large and small pieces of metal scrap from used foundry sand, and in application, simplicity of construction, efficiency, capacity, initial and running costs, it offers all the advantages and no disadvantages. It was primarily designed for this particular application, and is also not an experiment, as many are at present in use, although the development is within the last two years.

In the design of this drum the magnets are arranged so that, instead of the poles being parallel to the feed, thus creating neutral and inconsistent zones through which small pieces of scrap can pass unaffected, they (the magnet poles) are arranged across the face of the drum at right angles, so that the sand to be treated must pass through the strongest consistent magnetic fields of alternate polarity. These drums are so powerful that they will extract the most difficult of all test-pieces—a ball bearing.

The magnet unit is stationary, thereby not requiring a current collector gear, whilst the drum is steelclad and represents the only part movable, subject to wear. The cost per ton of sand treated by the separator alone is less than ½d. per hour, and the iron extracted, due to passing alternate polarity, is discharged free from sand on account of the gambolling effect such pieces of metal are subjected to during the travel over the magnet face of the drum.

It will be noted that the magnetic unit only magnetises one-half of the cylinder, and the position of this is adjustable radially. Jig-shaker feeds, as shown in Fig. 11, are recommended to produce an even and constant flow of material on to the top of the magnetic drum, and the scrap is separately discharged down the shute provided for it automatically, without the aid of either a mechanical scraper or brush, and without interfering with the electric circuit.

Fig. 15 shows one of these drums fitted with flanged end covers. The drives for these drums have to be arranged through a pulley, chain, or gear wheels fitted to an extended boss inside the bearing, because the latter is a fixture. In this case the locating pins for fixing the magnet unit in any desired position and the leads from the windings coming through the hollow shaft are clearly shown.

Fig. 16 shows a magnetic separator embodying a drum, as just described, complete with hopper having an adjustable feed regulator gate. Underneath the hopper is placed a jig-shaker feed tray, and the drum is chain-driven through a countershaft, whilst the main drive is obtained by belt, for which purpose a fast and loose pulley and belt-shifting mechanism is provided.

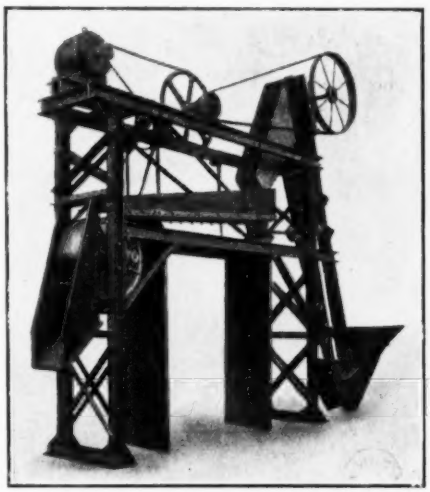


FIG. 18.—PLANT FOR TREATING DAMP BACKING SAND.

Fig. 17 shows a plant embodying a bucket elevator, magnetic drum and jig sifter for treating used dry foundry sand direct from the moulds. The magnetic separator treats the material before sifting takes place in this instance. Fig. 18 shows a very similar plant, but the sand to be treated was, in this instance, required for backing sand and due to it already being damp as received from a dump open to the elements, the variation of moisture content being considerable causes the drum to build up. Sifting, therefore, took place first, as small iron is not in such circumstances considered a disadvantage, and the separator extracted the valuable iron from the oversize foreign material prior to being dumped.

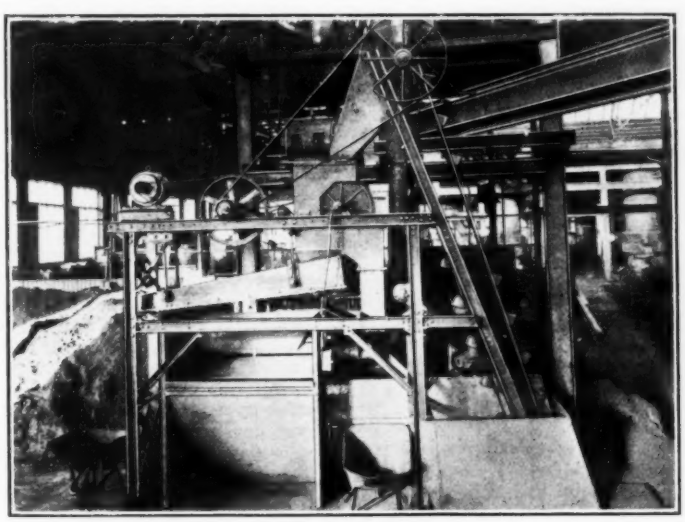


FIG. 17.—PLANT FOR TREATING USED DRY SAND DIRECT FROM MOULDS.

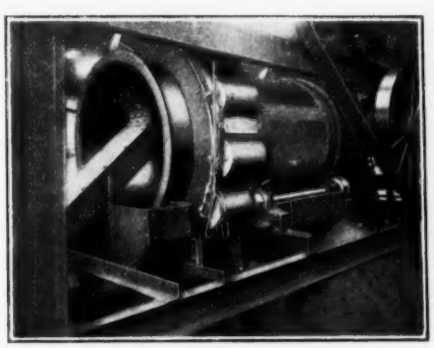


FIG. 19.—SEPARATOR SUITABLE FOR DEALING WITH LARGE QUANTITIES OF USED FOUNDRY SAND.

Large-Capacity Separators.

Fig. 19 shows a patented type of separator suitable for application to rotary cylinders and screens, for dealing with large quantities of used foundry sand, from, say, 10 to 100 tons per hour. The separator is of arcuate shape, and is arranged to envelope the bottom and one side of a cylindrical brass extension, fixed true to the dead plate, as part and parcel of the screen. The separator has an adjustable radial clearance, and

the coils are such that they create a magnetic field which impinges into the brass extension cylinder, on the inside of which, parallel to the axis, stretches a series of non-magnetic bars having magnetic feelers attached thereto.

These feeler bars, when the screen is in operation, comb through the sand in the vicinity of the magnetic field, and the feelers, thus magnetised by induction, pick out the large and small pieces of iron, carrying the same to the uppermost position, where they fall into a shute designed to divert the metal to a suitable receptacle provided for same. If the sand is dry, separation is better applied at the feed end of the screen, but if the moisture content in the sand is above 5 per cent., it is better to sieve first and separate afterwards, otherwise the sand will clog up. This screen type has not one single mechanical wearing part. Fig. 20 shows the complete plant in which the separator just described is embodied.

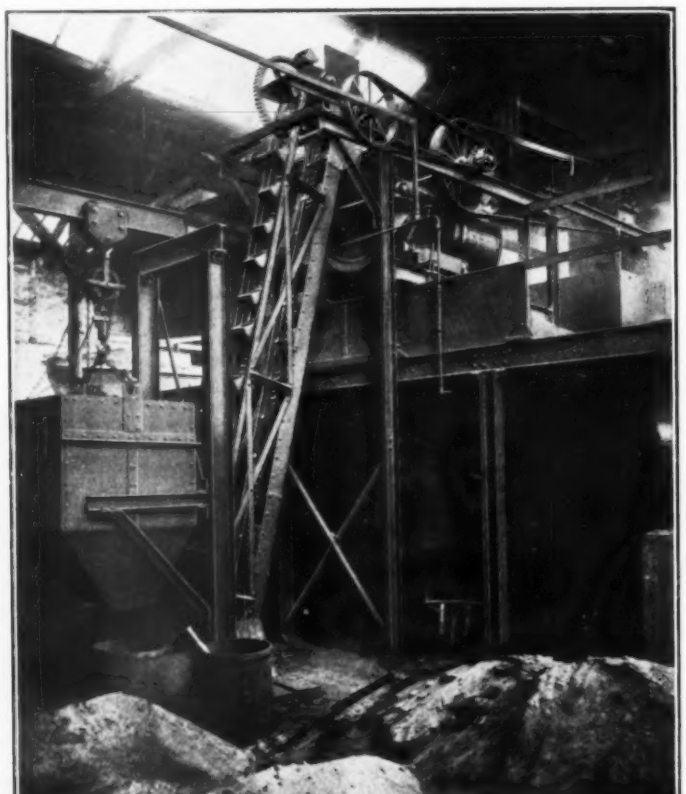


FIG. 20.—COMPLETE PLANT EMBODYING SEPARATOR SHOWN IN FIG. 19.

Sand from the knock-out stage is carried in a skip by means of a runway and feeds the boot of the elevator. This discharges it into a rotary screen and separator, or separates first and then screens, depending upon the condition of the sand. The sieved sand to be re-used falls on to the elevator platform, where it is mixed with a proportion of new sand and fed by hand shovel down a shute into a pan mill, where tempering takes place. The mill discharges subsequently the conditioned sand into skips for transportation back to the foundry.

Fig. 21 illustrates a special shunt break switch designed to control highly-inductive magnetic fields as met with generally in connection with all types of magnetic separators. It consists of d.p. fuses, d.p. switch and non-inductive resistance unit all enclosed in a cast-iron case. The switch has spring control, quick "make-and-break" action, and is operated by a crank handle.

This switch also is special in so far that it is arranged so that just previous to disconnecting the coil from the main circuit a non-inductive resistance is connected in parallel across the winding so that the destructive inductive effects due to the voltage rise produced by the field collapsing at a high speed dissipates gradually by surging through this closed internal circuit. If such a circuit is not controlled in this manner there is a tendency for the high pressure induced to break down the insulation. This type of switch is used for the control of small and medium-sized separators, and can be fitted either with a bell or visual alarm in the form of a red pilot-lamp, which is shown fitted at the top.

Fig. 22 is a view of a drum-type controller suitable for operating magnetic separator such as the screen type and such that consume large highly-induced currents. It is built up on the potentiometer principle and is foolproof in operation. Magnetic separators can only be wound for direct current, and where alternating current only is available, either belt-driven generators or motor generators will have to be installed as an alternative.

The information given in this Paper is based on the experience gained from the installation of over 30 equipments in this country alone. It is worth noting that any type of high-class magnetic separator can be manufactured in such a way that by using inferior material, construction and labour, the price can be halved. Before purchasing this class of equipment, it is therefore advisable carefully to compare specifications, get permission if possible to see one working under actual working conditions in a foundry, or obtain guarantees and tests enabling percentages of iron content and samples of sand to be obtained as a basis for consideration. In conclusion, the author acknowledges with gratitude the help accorded to him in the preparation of the Paper by his colleagues on the staff of the Rapid Magnetting Company, Limited.

DISCUSSION.

The PRESIDENT (Mr. D. Wilkinson) asked whether any definite figure could be given respecting the percentage of iron content extracted from sand by magnetic separators.

MR. BOX replied that it was impossible to give a definite figure, as this depended upon the type of castings produced, the way the metal was poured, and whether the sand was first riddled, etc. Where sand direct from knock-out grids was treated, results proved that as high as 12 per cent. relative to weight was actually extracted. On the other hand, if the material was riddled (which labour could be dispensed with by separation) the percentage of extraction was from 1 to 3½ per cent., and such metal extracted was in the form of special-shaped shots and such that passed through the meshes of the sieve. In any case the advantages were legion where magnetic separation was considered combined with sifting in a suitable plant also designed to reduce handling labour.

On behalf of an absent member, MR. F. K. NEATH (hon. sec.) said the member was experiencing difficulty through large quantities of sand being discharged with the iron from his existing pulley separator. What was the reason for this, and how could it be avoided?

MR. BOX replied that the separator in question was either of bad design or the wrong type for the duty it was put to perform. Other causes of the difficulty might be that the diverting shute under the drum was not in the most suitable position, or the sand might have too much moisture content, which caused it to stick to the belt and the iron extracted.

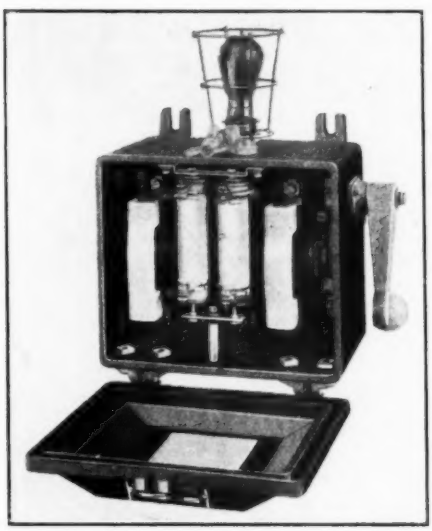


FIG. 21.—SPECIAL SHUNT BREAK SWITCH FOR CONTROLLING HIGHLY-INDUCTIVE MAGNETIC FIELDS.

The solution could better be given by closely watching the equipment under working conditions, but in any case the best type was the drum as described on Fig. 14, having an adjustable jig feed as shown by Fig. 16.

This type gave a gambolling effect to the iron whilst passing over the face of the drum, which action automatically released any sand adhering.

MR. G. M. CALLAGHAN asked whether any of these plants were working in this country.

MR. BOX said over 30 had been supplied of various types in this country alone, some for extracting iron only for its value from foundry refuse prior to dumping, and others embodying sifters, elevators, storage bunkers, aerators, mills and the like. Others had also been supplied abroad.

Running Costs.

MR. E. J. LEWIS inquired if the low figures given as running costs in the Paper included only the cost of power consumed.

MR. BOX: Yes. The cost at ½d. to 1d. per ton of sand treated includes only the cost of the mechanical power plus the electrical power consumed by the magnetic separator. The all-round saving of these plants is considered so large that, provided the correct size is installed to cope with the work, they pay for themselves and earn a profit within two years.

MR. BUCHANAN wanted to know why sifting took place. He would have thought that if the iron was extracted this second treatment was not necessary.

MR. BOX explained that sifting enabled the best fine sand to be saved, and as the sand must be reconditioned by the addition of a small proportion of new, it was advisable from this point of view. Apart from this, however, the sand was cooled and aerated whilst passing through the interstices of the sieve and dropping through the air. It must also be remembered that used sand from the foundry contained slag, char and occasionally non-magnetic metal, such as brass lubricators, and wood, glass, brickbats, etc., which it was desirable to extract for obvious reasons.

Lifting Magnets.

MR. D. H. WOOD said the Paper had not dealt with lifting magnets. He would like to hear whether Mr. Box could say whether any safety

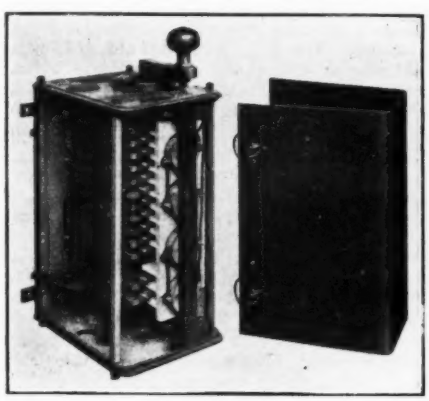


FIG. 22.—DRUM-TYPE CONTROLLER.

means had been devised for preventing the load a magnet was carrying from dropping if the current failed.

MR. BOX said lifting magnets would be the subject-matter of a Paper which would be delivered later. With reference to the question of safety devices for these equipments, such could be specially controlled through a dual relay, so that in the event of current failure a reserve battery came into use, and, at the same time, indication to the crane driver was given by a bell ringing. The steel used in the construction of magnets generally was such that the magnetism created by a flow of current in the coil took a considerable time to die down and the speed of the relay overcame what, otherwise, would be probably serious. This lagging of the magnetic field was a bugbear to the control of magnets, because the more rapid the discharge of the load the better the handling capacity. This was obtained at present by reversing the current flow through the coil by a suitable controller, and this method speeded up the collapsing of the magnetic field. Lifting magnets, however, were best applied to do away with ground labour, and, in any case, people generally knew how they functioned, and, generally speaking, did not walk under them. More accidents were recorded by broken slings and the like than by magnet applications, and he was not aware of a single fatal accident due to the application of lifting magnets.

Sifting.

MR. BUCHANAN asked if it was necessary to magnetically-separate used foundry sand at all if it was dried and subsequently sieved by a very fine sieve. Also, what could be done with the very fine shot, etc., which a magnetic-separator extracted?

MR. BOX, in answer, said sifting only with a very fine mesh would not be advisable excepting in very rare cases, and could only be applied for treating dried sand if the maximum efficiency was required.

Whatever the size of the mesh, fine iron was bound to be mechanically deposited with the sand, and the finer the mesh the greater the bulk of oversize sand and other non-magnetic material would be discharged with the metal. In order to obtain the clean iron which was valuable, further treatment would be necessary, and, if more tiers of sieves were installed, this operation was multiplied and the problem was further complicated. Fine sieves could not be made of the same mechanical robustness as larger meshes, and if sifting alone took place, the cost involved by stoppages, due to damaged sieves, the decrease in the speed of treatment and the extra cost for dryers and labour confined this possible system of treatment very considerably, and it was doubtful as a commercial proposition. In answer to the second part of the question, Mr. Box pointed out that these small pieces of iron, in the form of shots extracted by the separator, were at present used up in a number of foundries by placing them in a metal container and using a percentage with each cupola charge.

The PRESIDENT explained that he used the "fines" up in this way without going to the trouble mentioned by Mr. Box, and he found that they could be charged with the usual material, say at the last heat, when the temperature was at its highest, and so long as sand was not mixed with it, there was no difficulty, particularly where a high-class casting was not to be poured. If the heat was low, he also suggested that after charging the shot a further layer of coke could be put on the top of the shot in the cupola, which definitely gave good results, as such fines melted with ease.

Mr. Box was heartily thanked for his Paper.

Pattern-Shop Varnishes.

A Warning.

Although, perhaps, the practice of treating a cut finger with shellac varnish is not quite so common as in the past, it is still practised in many pattern-shops. The general idea is that such an application as described above protects the wound from dust and dirt and at the same time keeps the former open to the air, as would not be the case if bandaged. As regards the principle of keeping the wound open to the atmosphere, nothing can be said against this, but it is the method adopted which calls for great criticism.

Nearly all shellac varnishes contain wood alcohol, which is, of course, poisonous to the system. No doubt the alcohol will kill any germs likely to be on the cut, but the risk of blood-poisoning through other foreign matters present in the varnish is greater than imagined. It is even unadvisable to treat bruises with any common shellac.

The chief danger, however, comes from varnish which has been restored with oxalic acid—a common practice in numerous shops. Oxalic acid is in itself very poisonous, and should the person treated not be in good health the danger is much greater still.

If the management of every foundry would post notices prohibiting the use of all varnishes for cuts, etc., and fully explain the danger otherwise incurred, the practice would gradually die out and ultimately would be almost forgotten. No doubt there are many who have used varnishes for such purposes on numerous occasions and without any adverse effect. Perhaps they have been lucky—and yet the next time may bring about blood-poisoning. Iodine is much safer and is cheap enough to even the poorest firm.

The Institute of Metals.

As previously announced, the 23rd annual general meeting of the Institute of Metals will be held, by kind permission, in the Hall of the Institution of Mechanical Engineers, Storey's Gate, London, S.W.1, on March 11 and 12. On March 11 the annual dinner of the Institute will be held at the Trocadero Restaurant (Empire Rooms), Piccadilly Circus, W.1, at 7 for 7.15 p.m. The dinner will be followed by a dance ending at 1 a.m. The price of the tickets is 15s. each. The Birmingham Chamber of Commerce has again arranged for the Institute to make an official visit to the Fair, and has kindly invited the party to luncheon. The visit will take place on Friday, February 20. Members travelling to Birmingham from railway stations in Great Britain will be able to obtain tickets for the return journey at a single fare and a third if a reduced fare voucher is used.

Papers.

The following Papers are expected to be submitted:—

"Investigation of the Effect of Impurities on Copper. Part VII, The Effect of Antimony. Part VIII, The Combined Effect of Antimony and Arsenic," by S. L. Archbutt and W. E. Prytherch, M.Sc.

"Some Properties of Silicon-Aluminium Bronzes," by L. J. Brice, M.Sc.

"The Corrosion of Early Chinese Bronzes," by Captain William F. Collins, A.R.S.M.

"The Constitution of the Cadmium-Rich Alloys of the System Cadmium-Silver," by P. J. Durrant, M.A., Ph.D.

"An Investigation of the Microstructures of Fourteen Silver Greek Coins (500-300 B.C.) and some Forgeries," by C. F. Elam, M.A., D.Sc.

"The Rolling of Alloys of Copper and Phosphorus containing up to 5 per cent. of Phosphorus," by Owen W. Ellis, M.Sc.

"The Mode of Deformation of a Single Crystal of Silver," by H. J. Gough, M.B.E., D.Sc., and H. L. Cox, B.A.

"Dimensional Stability of Heat-treated Aluminium Alloys," by J. D. Grogan, B.A., and D. Clayton, B.Sc.

"The Flow of Aluminium at Elevated Temperatures," by Prof. D. Hanson, D.Sc.

"A Note on the Silver-Rich Aluminium-Silver Alloys above 600 deg. C.," by T. P. Hoar, B.A., and R. K. Rowntree, B.A.

"Some Properties of Metallic Cadmium," by C. H. M. Jenkins, D.Sc.

"The Effect of Artificial Ageing upon the Resistance of Super-Duralumin to Corrosion by Sea-Water," by K. L. Meissner, Dr.-Ing.

"The Influence of Pressure and Temperature on the Extrusion of Metals," by C. E. Pearson, M.Met., and J. A. Smythe, Ph.D., D.Sc.

"The Solid Solutions of the Copper-Silver System," by D. Stockdale, M.A., Ph.D.

May Lecture.

The annual May lecture will be delivered on Wednesday, May 6, by Mr. W. B. Woodhouse, of the Yorkshire Electric Power Company. It will deal with technical and economic progress in the generation of electric power on a large scale.

Autumn Meeting.

The Council has gratefully accepted an invitation to hold the annual autumn meeting in Zürich from September 13-16. The meeting will immediately follow the Zürich meeting of the New International Association for Testing Materials, to be held on September 6-11. It is hoped that it will be possible for members to take part in certain excursions to be arranged in connection with the N.I.A.T.M. meeting. Further details will be announced later.

The Spelter Market in 1930.

DECLINE IN PRICES CONTINUED.

In their annual review of the spelter market for 1930, Messrs. Rudolf Wolff & Company state that prices gradually declined throughout the year. Consumption has seriously fallen off and production has been reduced, but not to the same extent, with the result that heavy stocks have accumulated. The highest prices were ruling in January, when £20 2s. 6d. was paid, and the lowest in December, when the parity of £13 5s. was accepted, a level below which the market had not fallen since 1885, when £13 5s. was touched. Efforts were made to reconstitute an international cartel with the object of regulating output, sales and prices, and conferences of producers took place at different times. In the earlier discussions agreement in principle was reported to have been reached on a basis of fixed quotas, of which 77 per cent. was to be allotted to European and 23 per cent. to overseas producers (*i.e.*, Mexican, Rhodesian, Canadian and Australian; the United States of America not participating) for the duration of ten years, and it was generally anticipated that a reduction in output of 30 per cent. would be immediately enforced. At subsequent conferences, when it became necessary to arrange details and procure the co-operation of those producers who had hitherto held aloof, negotiations failed to progress, and the last meeting, held on November 29, was concluded without final definite agreement being reached.

Excessive Production.

Production has in the aggregate decreased, but nevertheless has been more than sufficient to meet all requirements. Output has declined most heavily in the United States of America and to a lesser extent on the Continent and in the United Kingdom, but increases have occurred in Canada, Australia and Rhodesia. Such curtailment as has taken place must be ascribed to economic necessity arising from an unremunerative price level. It seems a little remarkable that production was not brought more into line with consumption earlier in the year, but presumably some hopes were staked on the re-establishment of the cartel, whereby the decline would be arrested, and moreover, few, if any, would have predicted a fall of £6 per ton in the course of the year: on the contrary, even in January, when prices were highest, spelter was regarded as reasonably cheap, and at each successive fall it was confidently expected that the bottom had been touched. The later months, however, gave evidence of more drastic reduction, the output in the United States for November being about 9,000 tons less than in October, and smelters on the Continent and elsewhere were reported to be experiencing some difficulty in obtaining supplies of suitable ore.

Consumption has suffered from the general industrial depression and shows a marked falling-off. In the United States stocks amounted to 128,193 tons on December 31, as compared with 67,500 tons on January 1, 1930. In the United Kingdom stocks in official warehouses increased from 4,440 tons to 12,043 tons over the same period; whilst in unofficial warehouses in this country they are variously estimated from 20,000 tons to 25,000 tons, and on the Continent are estimated at 80,000 tons, as compared with about 45,000 tons a year ago. The serious decline which has taken place in the exports of galvanised sheets from this country reflects the unsettlement in India and the East, the financial crisis in Australia, and the political and financial difficulties of Brazil and the Argentine Republic. The brass trade has also suffered a serious set-back, particularly in the United States, due to depression in the motor industry. In zinc sheets, conditions have been comparatively better; demand has, on the whole, been fairly well sustained and imports into this country increased by 3,687 tons over the first eleven months of the year.

Remelted and Hard Spelter.

Business in remelted spelter was on a very reduced scale, and the price, following the course of the virgin market, declined consistently throughout the year. For the most part a poor demand was experienced on the part of consumers and buying was generally of a hand-to-mouth description owing to the depression in the galvanising industry; but, apart from the general downward tendency, movements were governed and the price ratio of remelted to virgin was determined more particularly by the producers of old zinc, who from time to time refused to sell in anticipation of sustained recovery, which only resulted in stocks accumulating and subsequent forced liquidation. As a consequence the margin between the two qualities varied considerably, ranging between a lowest of 5s. and a highest of about 40s. The highest price was realised in January at £19 and the lowest in December at £12 5s. c.i.f. British port. The course of the market in hard spelter calls for no particular comment. Production has, of course, declined, but consumption has correspondingly fallen off and supply and demand therefore have been fairly evenly balanced. Export business has suffered by reason of the unsettled conditions prevailing in India and the East, and to a further extent by restricted demand on the Continent, where buyers had no difficulty in filling their requirements from Continental sources. Producers, therefore, have been obliged to rely on the home trade to market their output, but as refiners and zinc-white manufacturers have generally paid full prices, satisfactory conditions from this point of view have for the most part obtained.

Future Prospects.

In circumstances of depression as they exist at present, whereby a variety of causes has contributed to create a situation for which no effective remedy has so far been applied, it becomes difficult to attempt a forecast. The price of spelter is admittedly low—in fact, the lowest in the last 45 years—and might be said fairly to reflect the adverse effects of a reduced consumption and accumulated stocks. Decreased consumption, however, is due to general trade depression, world-wide in character, and not to any specific cause attributable to spelter itself by reason of its replacement or suspension by any other metal or material. The uses of spelter are universal and must in normal times increase as the industrial world develops; restriction is in progress, and not by artificial means, but by reason of the unremunerative level to which the price has fallen, which sooner rather than later should result in equilibrium being reached. It would seem, therefore, that whatever further weakness, if any, ensues, it must arise from liquidations by tired and/or weak holders rather than from the pressure of current production, and as much of the old scattered "bull" account has been already liquidated there should be little need for serious apprehension in this direction. On the other hand, the price would quickly respond were confidence to return and the future to hold even moderate hope of an early revival in trade. Not that such a movement would go far, for supplies of ore and smelting capacity are fully equal to any demands that may be made on them, and spelter is produced to-day on more scientific lines and with greater economy than was the case 20 years ago.

Indian Rail Enquiry.

The Government of India have directed the Indian Tariff Board to inquire whether additional payment should be made to the Tata Company for rails in future contracts, and to report how the amount should be determined. It will be remembered that, following upon the recommendation made by the Tariff Board in 1926, the Government had made a contract with the Tata Company to purchase rails from them at the rate of Rs. 110 per ton (£8 5s.) for seven years as from April, 1927.

In September, 1930, the Government of India agreed to an extra payment of Rs. 20 (30s.) on each ton of rails, for the fiscal year 1930-31. This additional payment was made as an act of grace on the ground that the annual quantity of rails taken by the Government had on the average fallen considerably below the estimate upon which the scheme of protection had been based.

In view of this curtailment and the probability that the quantity of rails to be ordered during the remaining years of the contract will continue to fall considerably short of the original estimate, the Government of India desire to consider whether, until the period covered by the contract terminates, an additional payment per ton of rails should not be made. Orders have also been placed with the company for 115-lb. rails, which are not covered by the terms of the original contract, and the Tariff Board is also asked to report what additional payment, if any, should be made in respect of them.

John Shaw & Sons (Wolverhampton), Limited.—Net profit, £5,441; brought in, £31,552; preference dividend, £7,344; carried forward, £29,644.

We Have Received.

Calendars.—From **T. W. Ward, Limited,** Albion Works, Sheffield, a daily tear-off, in the form of a horseshoe, advertising Ketton cement. **The Carborundum Company,** a monthly tear-off, carrying a picture of an American Indian's head. **H. Hendry & Son,** ironfounders, Townmead Road, Wandsworth Bridge Road, London, S.W.6, a monthly tear-off, carrying a picture "An Amateur Movie." **Smith & Fawcett,** Horton Works, Lidget Green, Bradford, a monthly tear-off, carrying an excellent illustration of their iron foundry. **Crofts (Engineers), Limited,** Bradford, a monthly tear-off, each month advertising a different branch of their manufactures. **The Liverpool Electric Cable Company, Limited,** Linacre Lane, Bootle, Liverpool, a monthly wall calendar, carrying a seascape which includes the S.S. "Royal Iris" and "Royal Daffodil." **Light Alloys, Limited,** Alpax Works, St. Leonard's Road, Willesden Junction, N.W.10, a calendar which is made up of 12 aluminium-coloured cardboard sheets attached by a cord, one for each month. They carry interesting examples of the application of the castings they manufacture. **T. L. Hale (Tipton), Limited,** Dudley Port, Tipton, Staffs, a refill for the daily tear-off calendar. **Demag Aktiengesellschaft,** Duisburg, a refill for their very practical desk calendar.

Diaries.—**H. G. Sommerfield, Limited,** Charterhouse Chambers, Charterhouse Square, London, E.C.1, a desk engagement diary, containing post-office regulations and seven days to the page. **The United Steel Companies,** Sheffield, desk engagement diary, seven days to the page, and interleaved here and there with excellent publicity matter for the various concerns connected with this firm. The pocket diary—two pages to a week—received from **Frank Wigglesworth & Company, Limited,** Clutch Works, Shipley, contains no less than 162 pages of technical tables, yet the bulk is quite reasonable and the data have been well chosen. **The Staveley Coal & Iron Company, Limited,** near Chesterfield, a leather-bound pocket diary, which contains technical data required by the cast-iron pipe and foundry industries. **British & Continental Traders, Limited,** Astor House, Aldwych, London, W.C.2, a leather-bound pocket diary, which has been specially designed for the use of foundry engineers and metallurgists. **Watsons (Metallurgists), Limited,** Lancaster Street, Sheffield, a pocket diary which contains a minimum of advertisement and is beautifully bound in leather. **Vereinigte Stahlwerke A.-G.,** Bochumer Verein, Bochum, Germany; this diary, unlike the British type, puts its postal and statistical information at the end of the diary. Anybody who travels in Germany from time to time will find a mass of very useful information. **J. Stone & Company, Limited,** Deptford, S.E., an exceptionally well-presented waistcoat pocket diary.

Blotters.—We have received those very useful combination engagement diary, calendar and desk blotters from **Gibbons Brothers, Limited,** of Dudley, and **The British Chilled Roll & Engineering Company, Limited,** Haverton Hill. The former is interleaved with advertising matter, whereas the latter carries slots for the insertion of clean blotting paper. From **Beecroft & Partners, Limited,** Mappin Works, Sheffield, a wall thermometer, graduated in both Fahrenheit and Centigrade degrees.

We heartily reciprocate the good wishes which accompanied these tokens of goodwill.

Nitriding Temperatures.—If extreme hardness is required by nitriding, a temperature of 510 deg. C. is usually employed. If ductility, combined with hardness, is desired, then temperatures of up to 620 deg. C. may be used. It must be remembered, states "The Iron Age," that, while a ductility of the case is obtained, the hardness decreases to a marked extent.

Trade Talk.

THE BARROW HEMATITE STEEL COMPANY, LIMITED, have decided to restart their steelworks and blast furnaces this week.

THE SHIPYARD OF Messrs. Workman Clark (1928), Limited, Belfast, which was closed before Christmas, will be reopened on February 16.

MESSRS. VICKERS-ARMSTRONGS, LIMITED, Elswick, have received an order for two pairs of lock gates for the Shoreham Harbour works.

THE ANNUAL GENERAL MEETING of the London Iron and Steel Exchange is to be held at the Cannon Street Hotel on Tuesday, January 27, at 3 p.m.

EMPLOYEES OF Messrs. Stewarts & Lloyds, Limited, of Glasgow, contributed during 1930 the sum of £4,990 to infirmaries and charitable institutions in the West of Scotland.

THE NORTH BRITISH LOCOMOTIVE COMPANY, LIMITED, Springburn, Glasgow, have received an order for four locomotives for the Bombay, Baroda and Central India Railway.

OWING TO THE LOW PRICE of spelter, over 200 employees of the Sulphide Corporation, Limited, at their zinc works at Seaton Carew have received notices to finish work.

THE ANNUAL DANCE of the Royal Metal Trades Pension and Benevolent Society is to be held at the Hotel Victoria, London, W.C., on Friday, March 20. Mr. James E. Bennett (Crane-Bennett, Limited) will preside.

THE SINGLE-SCREW cargo coasting steamer "Progress," built for the Co-operative Wholesale Society by Sir W. G. Armstrong Whitworth & Company (Shipbuilders), Limited, was launched from their South Yard, Walker, on January 5, 1931.

MESSRS. SWAN, HUNTER & WIGHAM RICHARDSON, LIMITED, have received an order for a cargo vessel of 3,000 tons for Canadian owners. The vessel will be built at the firm's Southwick yard and the machinery at the Neptune Works, Walker-on-Tyne.

IN GERMANY a selling cartel for galvanised hardware was recently formed under the name of Blewa G.m.b.H., with offices in Berlin. The new cartel does not only control the home market, but also the exports of the twenty works forming the cartel. The agreement is to last until the year 1940.

MESSRS. VULCAN FOUNDRY, LIMITED, of Newton-le-Willows, Lancashire, have contracts for ten locomotives for the Great Indian Peninsula Railway, seven for the North-Western State Railway (India), ten for the East Indian Railway, and six for the Madras & Southern Mahratta Railway, making a total of 33.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED, Rugby, have been successful in obtaining an order from the London County Council for two 20,000-kw. turbo-alternators, complete with feed pumps, heater, evaporators and condensing plant. These sets will be installed in the Greenwich Power Station for supplying power to the L.C.C. tramway system.

DETAILS ARE NOW AVAILABLE of the South Scotland Electricity Scheme, which is the ninth to be prepared by the Electricity Commissioners in connection with the national reorganisation of electricity supply. Only one more scheme—namely, that for the North of Scotland—is required before the whole of Great Britain will be covered by regional schemes, when the plan foreshadowed by the Electricity (Supply) Act, 1926, will be on the way to full operation.

MESSRS. GEORGE COHEN, SONS & COMPANY, LIMITED, 600, Commercial Road, London, E.14, have purchased the complete plant of several Cornish tin mines for dismantling. The majority of the plant is quite modern, having been installed new during the past three years. Included are three complete power houses, comprising heavy-oil engines and generators, also pumping sets, mining and mineral plant, winding engines and aerial ropeway and a large quantity of electrical and other plant.

MESSRS. AUGUST'S MUFFLE FURNACES, LIMITED, Thorn Tree Works, Exmoor Street, Halifax, have recently been successful in securing a contract from Messrs. John Harper & Company, Limited, Albion Works, Willenhall, Staffs, for a complete sand-mixing and preparing installation. The installation includes a facing-sand preparation of an hourly capacity of 10 tons in six different mixtures. The plant is semi-automatic in operation, receiving used foundry sand and screening, cooling and cleaning it. Iron is also removed magnetically. The plant consists of two No. 2-size Simpson patent intensive sand mixers, August disintegrators, bunkers, conveyors, elevators and magnetic separators.

MESSRS. HENRY WALLWORK & COMPANY (1920), LIMITED, Red Bank, Manchester, referring to the dispute at their works, state that the works proper are in production, and that they have offered their semi-skilled employees piece prices which would enable grinders and fettlers to earn 45 per cent. above their base rate, and semi-skilled machine operators 50 per cent. above their base rate, with overtime for piece workers paid for at the rate of 50 per cent. on their day rate, including the 10s. per 47-hour week cost-of-living bonus, but not including the more recent 2s. per 47-hour week cost-of-living bonus, which was an award to day workers only.

THE ANNOUNCEMENT that the Hope Foundry estate at Mabgate, Leeds, is to be sold by private treaty means that the Lawson branch of the textile engineering firm of Messrs. Fairbairn, Lawson, Combe, Barbour, Limited, has been closed as part of the scheme of reorganisation in progress. The works, including sheds, warehouses, foundry and offices, cover a ground area of over seven acres. The work of the Lawson branch and the people employed at the firm's Mabgate works have been transferred to the company's Fairbairn branch in Wellington Road, Leeds, which will continue as usual. The changes now being made are part of the plans recommended by the reconstituted board of directors for the rationalised use of the company's establishments.

AT THE MONTHLY MEETING of the Executive Council of the Association of British Chambers of Commerce, recently, the following resolution was unanimously adopted:—"The Association of British Chambers of Commerce has on many occasions expressed the opinion that, if the export trade of the country is to be developed, there should be a substantial reduction in the cost of transport. The Executive Council of the Association, in a special report dealing with the question of unemployment, dated July 29, 1930, expressed the opinion that among the causes of our loss of trade was the high level of transport charges. The Committee on Industry and Trade, in their final report (March, 1929), expressed the view that the burden of railway charges on the heavier trades was greater than they could bear, and that, however reasonable such services might be having regard to the cost at which the services were being maintained, they were affecting seriously our competitive position in the markets of the world. The Association is of the opinion that the time has now come when every effort should be made to bring about the reductions in transport charges."

New Companies.

Tool Metal Manufacturing Company, Limited, 11, Victoria Street, London, S.W.—Capital £1,000.

R. Blackett Charlton & Company, Limited, The Manors Brass Works, Newcastle-upon-Tyne.—Capital £7,000. Brassfounders, etc.

I. Warshawer & Son, Limited, 321, Old Street, London, E.C.—Capital £10,000. Brassfounders, etc. Life directors: N. Warshawer and S. S. Warshawer.

Mortimer Welding Company, Limited, 10, Coleman Street, London, E.C.—Capital £4,008 in £1 shares. Directors: G. S. Loraine, S. H. Mills and A. Lowne.

William Bywater, Limited. — Capital £10,000. Textile machinery makers, etc. Permanent governing director: W. B. Bywater, 9, Park View Crescent, Roundhay, Leeds.

Barnes & Pye, Limited, St. Miles Foundry, Colegate Street, Norwich.—Capital £8,000. Ironfounders, etc. Directors: J. Pye, L. B. Mabbott and R. W. Houseago.

Frome Castings Company, Limited, 12, Marston Lane, Frome.—Capital £2,000 in £1 shares. Directors: H. B. Smith (permanent managing director), C. Perkins and A. G. Davage.

Harry Astbury, Limited, Abbey House, 63, Hockley Hill, Birmingham.—Capital £1,000. Mechanical and electrical engineers, etc. Directors: H. Astbury (permanent) and E. E. Smith.

Dudley Guild, Limited, Royal London House, 35, Paradise Street, Birmingham.—Capital £500. Iron and steel manufacturers, etc. Directors: W. E. Martin, E. J. Ruffell and E. F. C. Roberts.

J. Bolson & Son, Limited, Skylark's Nest, Norwich Road, Bournemouth.—Capital £5,000. Shipbuilders, etc. Directors: J. Bolson (chairman and permanent director), Mrs. E., H. J. and Miss E. Bolson.

Personal.

SIR HUGO HIRST, BT., has been elected President of the British Export Society.

COL. S. H. POLLEN has resigned the chairmanship of the British Aluminium Company, Limited, but retains his seat on the board. Mr. R. W. Cooper has been appointed chairman.

MR. DAVID J. BARR, who is at present general manager of the Glasgow Iron & Steel Company, Limited, has been appointed managing director of the Wilsons & Clyde Coal Company, Limited, and its subsidiary companies.

MR. HUGH QUIGLEY is resigning his position as chief economist to the British Electrical and Allied Manufacturers' Association to take up the position of chief statistical officer and economist to the Central Electricity Board.

SIR JAMES LITHGOW, BT., has been nominated for a second year's term of office as President of the Federation of British Industries. The Grand Council of the Federation recommends that Sir Arthur Duckham should be elected Deputy-President for the ensuing year, with a view to his succeeding Sir James Lithgow as President in 1932.

Wills.

JORDAN, C. H., author of "Jordon's Tabulated Weights of Iron and Steel" £2,296

DAVAGE, T., for many years works manager of Messrs. Thomas Firth & Sons, Limited £18,719

Contracts Open.

Blackpool, January 31.—Iron and steel, for the Corporation. The Borough Treasurer, Town Hall, Blackpool.

Dundee, February 11.—4-ton, overhead, travelling hand crane, for the Town Council. Mr. D. H. Bishop, general manager and engineer, Electricity Supply Department, Dudhope Crescent Road, Dundee.

Eggborough, Yorks.—3,700 yds. of 3-in. cast-iron water mains, etc., for the Pontefract Rural District Council. Mr. J. E. White, engineer. (Fee £2, returnable.)

Hull, January 28.—Iron and steel, for the Corporation. The City Engineer's Office.

London, W., January 24.—Iron and steel, for the Paddington Borough Council. The Borough Treasurer, Town Hall, Paddington, W.2. (Fee 2s. 6d., non-returnable.)

Wellington, N.Z., May 5.—66-kv. and 33-kv. outdoor switchgear, for the Public Works Department, New Zealand. The Department of Overseas Trade. (Reference A.X. 10,722.)

Company Meeting.

Manganese Corporation (1929), Limited.—Presiding at the first ordinary general meeting of the Manganese Corporation (1929), Limited, held in Johannesburg, MR. W. H. SOMERSET BELL said that during the past year a number of sales had been negotiated, covering a total of over 200,000 tons of ore for delivery during the first year of working to buyers in France, Great Britain, Germany, Belgium, the United States and Japan. Some of these contracts were in the nature of trial orders, but those customers who had already received trial shipments had all expressed their satisfaction with the quality of the ore, and some were pressing for further deliveries. They did not anticipate any difficulty in selling their entire production, even during the present period of depression in the base metal market. Their total shipments of ore from Durban to December 1 last were 41,564 tons, and their total production approximately 110,000 tons. They were at present railing approximately 1,000 tone of ore per day to Durban. Several mining companies in the neighbourhood of Postmasburg had manganese ore deposits on their properties, and arrangements had been made with two of the most favourably situated of these companies, which might result in the purchase by the Corporation, at a remunerative price, of up to 120,000 tons per annum of high-grade ore. They anticipated no difficulty in selling this tonnage in addition to their own production.

XUM

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—Taking into consideration the industrial depression, the response to the reduction of Cleveland pig-iron prices has been fairly satisfactory. It would appear that the fall in prices has checked fresh purchases of iron from other areas, and also from the Continent, of which extensive use has latterly been made by local consumers, and this alone will considerably increase the demand for Cleveland iron. But, in addition to this, there is evidence that lower prices will extend the area of distribution of Cleveland iron. Coastwise shipments and rail deliveries already show some expansion, and employment for the limited number of furnaces in blast now appears to be assured. Export business is very quiet, Cleveland prices being not yet on a competitive level in neutral markets. On the other hand, business in Scotland has improved, but only on the basis of preferential prices, which are still quoted to Scottish consumers. With this exception, uniform quotations to all destinations are now as follow:—No. 3 Cleveland G.M.B., 58s. 6d.; No. 1 foundry iron, 61s.; No. 4 foundry, 57s. 6d.; No. 4 forge, 57s. per ton.

There is a considerable difference between Cleveland foundry and East Coast hematite prices. Little more than a year ago the margin was only 4s., and normally it amounts to about 7s. to 8s. per ton. To-day, however, the variation in the quotations for the standard No. 3 G.M.B. quality and East Coast mixed numbers amounts to no less than 11s. 6d. Consumers argue that this is excessive, and they are pressing for a reduction, which the makers are disinclined to concede. It may be that for a good order 70s. per ton could be shaded, but this is the general market quotation, and some of the makers ask up to 71s. They affirm that sales are maintained at this level, and, as stocks have been reduced, there is less pressure to sell at low prices. No. 1 hematite is quoted at 70s. 6d. per ton. On the North-West Coast, Bessemer mixed numbers are quoted at 70s. per ton at works.

LANCASHIRE.—The market is still very dull. There is an absence of forward contract buying, even for short periods, and there seems little prospect of any developing until after the meeting of Midland makers at the end of the month. There has been no change in prices since last week. Derbyshire and Staffordshire No. 3, for delivery to users in the Manchester price zone, are on offer at 69s. 6d. per ton, Derbyshire forge at 64s. 6d., Northamptonshire foundry at 68s., Cleveland at around 71s., Scottish brands of No. 3 at from 90s. to 91s., and West Coast hematite iron at about 84s. 6d. per ton.

THE MIDLANDS.—Consumers, having few orders for castings and little new business of any account, are only buying in small quantities. Moreover, it is considered that this is not a good time to enter the market, considering that prices come up for revision by the pig-iron producers at the end of the month. Values are unchanged meanwhile at 67s. 6d for No. 3 Northants and 71s. for Derbyshire and Staffordshire No. 3, these figures including delivery to local stations.

SCOTLAND.—Business is extremely quiet, and engineering founders especially are badly placed. Little improvement can be expected while the shipbuilding industry is so quiet. The price of Scottish hematite has been reduced by 1s. per ton, making the quotation 75s. f.o.t. steelworks. The makers have also reduced the price of No. 3 foundry, which is now at 73s. 6d. f.o.t. furnaces, a fall of 3s.

Finished Iron.

The situation is most unsatisfactory, and there seems no prospect of an immediate change for the better. The makers of marked bars are hoping that shortly conditions will be improved. They are adhering to the price of £12 10s. at works for this grade. The lack of orders is particularly noticeable in connection with crown and nut and bolt iron. Crown bars are quoted at £9 15s. to £10 5s., according to specification, while nut and bolt iron is offered at between £8 15s. and £9. There is not likely to be any improvement in the demand for bolt iron while Continental material is available at such low figures. There has been a reduction during the last few days in the price of Belgian No. 3, which is now offered delivered in the Midlands at between £5 2s. 6d. and £5 5s. There is no bulk business going through to the Continent even at these low rates.

Steel.

At a meeting of the Steel Association last week it was decided to increase the rebates allowed in respect of plates, sections and joists. The home price of plates and sections is unchanged, but the rebate is increased by 5s. In the case of joists, the rebate is increased by 10s., and the home price advanced by 5s. The result of this is that members of the scheme will pay 5s. less than hitherto for joists, but buyers outside the scheme will have to pay 5s. more than under the old prices. It is hoped that increased trade will result from these concessions. The market for semi-finished steel is dull. Although British prices are lower than they were a few months ago, makers are receiving little business for either billets or sheet bars.

Scrap.

In Cleveland the fall in pig-iron prices has had a depressing effect on the scrap market, and in every case where changes have occurred they have had a downward tendency. Ordinary-quality cast-iron scrap is at 48s. per ton, with machinery quality at 51s. The scrap market in the Midlands is still very quiet. Many of the works are not yet taking their usual supplies, and dealers are having difficulty in getting their supplies forward. Heavy machinery cast-iron scrap is offered at 60s. delivered, and ordinary heavy metal at 57s. 6d., with light cast-iron scrap at 45s. delivered. In Scotland also the iron and steel scrap market is in a poor condition. Outlets for all classes of scrap are few, and consumers are only taking deliveries in small quantities. There is no incentive to merchants to place contracts for scrap when delivery instructions cannot be obtained, and it is felt that there will be no fluctuation in prices for a considerable time. First-quality machinery cast-iron scrap, suitable for foundries, is at 55s., with ordinary cast iron to the same specification at 51s. 3d., cast-iron railway chairs 54s., light metal 40s., and furnace firebars at 37s. 6d. The above prices are all per ton delivered f.o.t. consumers' works.

Metals.

Copper.—There were two reductions in the exporters' quotations, each of 25 points, which brought the price down to 10.30 cents c.i.f., or £47 11s. 3d. The downward course of refined copper has been followed by standard, and the general tone of the markets has not been too good. The American copper statistics revealed for the first time since October, 1929, a decrease in the stocks of refined copper on hand. The exports showed a drop on the previous month, which, however, was counterbalanced by an increase in the domestic deliveries. The refined output, however, showed a fall of about 6,000 tons, resulting in the stock being drawn upon to the extent of some 2,750 tons. The figures generally were not unfavourable, but whether they will cause renewed interest in the metal remains to be seen.

Closing quotations :—

Cash.—Thursday, £44 11s. 3d. to £44 12s. 6d.; Friday, £44 11s. 3d. to £44 13s 9d.; Monday, £45 12s. 6d. to £45 13s. 9d.; Tuesday, £45 1s. 3d. to £45 3s. 9d.; Wednesday, £45 to £45 1s. 3d.

Three Months.—Thursday, £44 8s. 9d. to £44 10s.; Friday, £44 8s. 9d. to £44 11s. 3d.; Monday, £45 10s. to £45 11s. 3d.; Tuesday, £44 17s. 6d. to £45; Wednesday, £45 to £45 1s. 3d.

Tin.—Business continues to be quiet, and consumers are not taking much interest in the market, even at the lower level. Dealings on 'Change are in the hands of professional operators, and the market is likely to be erratic for some time to come. America has shown some interest, but, on the whole, buying is restricted, and the standard market is only moderately active.

Official closing prices :—

Cash.—Thursday, £113 to £113 2s. 6d.; Friday, £114 to £114 5s.; Monday, £116 10s. to £116 15s.; Tuesday, £114 17s. 6d. to £115; Wednesday, £117 5s. to £117 10s.

Three Months.—Thursday, £114 7s. 6d. to £114 10s.; Friday, £115 5s. to £115 10s.; Monday, £117 15s. to £118; Tuesday, £116 5s. to £116 7s. 6d.; Wednesday, £118 15s. to £118 17s. 6d.

Spelter.—A little scattered buying has been seen, but conditions are bad in the consuming trades, and even the present price is little incentive to users.

Daily fluctuations :—

Ordinary.—Thursday, £12 13s. 9d.; Friday, £12 8s. 9d.; Monday, £12 12s. 6d.; Tuesday, £12 11s. 3d.; Wednesday, £12 12s. 6d.

Lead.—Lack of demand and weakness in other metals have operated to bring about a further decline. Warehouse stocks are ample, and there seems little hope of any improvement in values at present.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £14; Friday, £13 15s.; Monday, £13 15s.; Tuesday, £13 13s. 9d.; Wednesday, £13 12s. 6d.

Students' Corner.

(*Continued from page* 34).

Q.—Are there any precautions or rules to follow regarding pouring basins?

To withstand a long "drop" of fluid iron from the ladle lip, which cannot always be avoided when starting to team a heavy casting, a piece of dried loam cake, slightly dished to form a well, should be bedded into the surface of the sand basin where the "drop" or "fall" of the molten metal impinges. This piece of loam cake withstands the continual "beat" and flow of the metal during pouring. The safest pouring basins, or channels, for very heavy castings are loam made and dried. When properly made or bricked, these will stand handling without injury, and can, if needed, with a little mending, be used more than once, as it is seldom that anything goes wrong with them. These are prepared in a separate suitable metal casing, and dried before required. Before pouring, in many cases, with both small and large castings, a runner basin is incomplete without stoppers.

Q.—For what purpose are stoppers, and of what are they made?

A.—Stoppers are used as a precautionary measure to prevent loose sand or scum entering the mould through the down-gates, which they cover until the pouring basin is full, when they are lifted, thus enabling the pourer to keep a full basin, which must not be allowed to empty itself during the cast, or at least until the mould is filled. Any loose sand or scum that enters the basin naturally floats on the top. Various kinds of stoppers are used when clean castings are important. For large, heavy castings (in which case the pouring basin often contains from one to two tons of metal before the stoppers are lifted), such stoppers are often loam-made. These need careful manipulation, they are composed of windings of hemp, or small straw ropes, and soft plastic loam on to a piece of wrought iron of a suitable length and diameter, with a lifting eye at one end, and split at the other end partly turned upwards in order to assist in carrying the weight of loam when the stoppers are lifted. When making these, relays of the materials are added a little at a time, and between each relay they are dried. Loam-made stoppers often cover a 3-in. square, or 3-in. round down-gate. With medium size, and many smaller castings, an iron stopper is used, which may take the form of a flat square, or round, cast on to the opposite end of the eye of the lifting rod.

(*To be continued.*)

Sterling

ALL STEEL TUBULAR

WHEELBARROWS

ARE IDEAL FOR ALL FOUNDRY PURPOSES.
THEY POSSESS MANY IMPORTANT ADVANTAGES.

Tray set well forward.
The load is on the Wheel.

Tray Reinforced with Stout Continuous Rod.

Broad Tyred 10-spoke Wheel.

Substantial Nose for forward dumping.

Strong Tubular Handles.

Patent Clip avoids perforating the Handle at point of strain.

Legs strongly braced cannot get shaky.

Pre-lubricated Axle-bearings. Never require oiling.

Legs bent square and fitted with renewable Shoes.

A Sterling Product designed for hard work and built to last.
All parts are standardised and interchangeable for repairs.
Capacities from 2½ to 6 cubic feet.
Also special barrows for pig iron and coke.

Write for Booklet No. W.39.

STERLING FOUNDRY SPECIALTIES Limited
LONDON OFFICE:—13 VICTORIA STREET, S.W.1
AGENTS AT MANCHESTER, GLASGOW & NEWCASTLE-ON-TYNE.
BEDFORD

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	45	0	0
Three months	45	0	0
Electrolytic	47	10	0
Tough	45	15	0
Best selected	46	5	0
Sheets	76	0	0
India	58	10	0
Wire bars	47	11	3
Do. March	47	11	3
Do. April	47	11	3
Ingot bars	47	11	3
H.C. wire rods	49	10	0
Off. av. cash, December	46	16	4 1/16
Do., 3 mths. December	46	13	7 1/16
Do., Sttlmnt., December	46	15	11½
Do., Electre, December	50	14	5½
Do., B.S., December	48	15	7½
Do., wire bars, December	51	7	7½
Solid drawn tubes			11½d.
Brazed tubes			11½d.
Wire			7¾d.

BRASS.

Solid drawn tubes	10d.
Brazed tubes	12d.
Rods, drawn	9½d.
Rods, extd. or rlld.	5½d.
Sheets to 10 w.g.	8½d.
Wire	8½d.
Rolled metal	7½d.
Yellow metal rods	5½d.
Do. 4 × 4 Squares	6½d.
Do. 4 × 3 Sheets	6¾d.

TIN.

	£	s.	d.
Standard cash	117	5	0
Three months	118	15	0
English	118	10	0
Bars	118	0	0
Straits	118	17	6
Australian	117	7	6
Eastern	118	0	0
Banca	118	17	6
Off. av. cash, December	111	12	4½
Do., 3 mths., December	112	17	10½
Do., Sttlmt., December	111	12	4½

SPELTER.

	£	s.	d.
Ordinary	12	12	6
Remelted	11	10	0
Hard	9	10	0
Electro 99.9	14	15	0
English	13	0	0
India	11	5	0
Zinc dust	18	15	0
Zinc ashes	3	0	0
Off. aver., December	13	19	9½
Aver., spot, December	13	15	2⅞

LEAD.

	£	s.	d.
Soft foreign ppt.	13	12	6
English	15	0	0
Off. average, December	15	5	8⅛
Average spot, December	15	5	7⅞

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	22	0	0
Do. V.M. ex-whf.	22	15	0
Rods	24	10	0
Boiler plates	18	5	0
Battery plates	19	0	0

ANTIMONY.

	£	s.	d.
Special brand, Eng.	36	0	0
Chinese	25	15	0
Crude	22	0	0

QUICKSILVER.

	£	s.	d.
Quicksilver	22	7	6

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro-silicon—			
25%	7	17	6
45/50%	11	10	0
75%	18	10	0
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% c. free	4/2 lb. Mo.		
Ferro-titanium—			
23/25% carbon-free	9½d. lb.		
Ferro-phosphorus, 20/25%	£15	17	6
Ferro-tungsten—			
80/85%	2/3 lb.		
Tungsten metal powder—			
98/99%	2/6 lb.		
Ferro-chrome—			
2/4% car.	£30	10	0
4/6% car.	£23	5	0
6/8% car.	£22	10	0
8/10% car.	£22	0	0
Ferro-chrome—			
Max. 2% car.	£32	10	6
Max. 1% car.	£37	5	0
Max. 0.70% car.	£40	2	6
70% carbon-free	10d. lb.		
Nickel—99% cubes, or pellets	£170	0	0
Ferro-cobalt	9/6 lb.		
Aluminium 98/99%	£85	0	0
Metallic chromium—			
96/98%	2/7 lb.		
Ferro-manganese (net)—			
76/80% loose	£11 0 0 to £11 15 0		
76/80% packed	£12 0 0 to £12 15 0		
76/80% export	£11 0 0 to £11 10 0		
Metallic manganese—			
94/96% carbonless	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	£0	2	2
Finished bars, 18% tungsten	£0	3	0

Per lb. net, d/d buyers' works.

Extras—

Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 7/32 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ½ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.		£	s.	d.
Heavy steel	2	5	0	to	2	7	6
Bundled steel and shrngs.	1	15	0	to	1	18	6
Mixed iron and steel	1	17	6	to	2	0	0
Heavy cast iron	2	5	0	to	2	7	6
Good machinery for foundries					2	10	0

Cleveland—			
Heavy steel	2	6	0
Steel turnings	1	15	0
Cast-iron borings	1	10	0
Heavy forge	3	2	6
W.I. piling scrap	2	12	6
Cast-iron scrap	2 8 0 to 2 11 0		

Midlands—			
Light cast-iron scrap	2	5	0
Heavy wrought	2	10	0
Steel turnings	—		

Scotland—			
Heavy steel	2	10	0
Ordinary cast iron	2	11	3
Engineers' turnings	1	12	6
Cast-iron borings	1	12	6
Wrought-iron piling	2	17	6
Heavy machinery	2	15	0

London—Merchants' buying prices delivered yard.

	£	s.	d.
Copper (clean)	38	0	0
Brass	28	0	0
Lead (less usual draft)	12	10	0
Tea lead	9	0	0
Zinc	7	10	0
New aluminium cuttings	50	0	0
Braziery copper	35	0	0
Gunmetal	37	0	0
Hollow pewter	76	0	0
Shaped black pewter	56	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	70/6
Hematite M/Nos.	70/-

N.W. Coast—	
Hem. M/Nos. d/d Glas.	78/-
„ d/d Birm.	88/6

Midlands—	
Staffs. common*	—
„ No. 4 forge*	66/-
„ No. 3 fdry.*	71/-
Shrops. basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	62/6
„ fdry. No. 3*	67/6
Derbyshire forge*	66/-
„ fdry. No. 3*	71/-
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	76/-
„ No. 3	73/6
Hem. M/Nos.	75/-

Sheffield (d/d district)—	
Derby forge	61/-
„ fdry. No. 3	66/-
Lincs. forge	—
„ fdry. No. 3	66/-
E.C. hematite	82/6
W.C. hematite	86/6

Lincs. (at furnaces)—	
Forge No. 4	—
Foundry No. 3	—
Basic	—

Lancashire (d/d eq. Man.)—	
Derby forge	64/6
„ fdry. No. 3	69/6
Staffs foundry No. 3	69/6
Dalzell, No. 3 (special)	105/- to 107/6
Summerlee, No. 3	90/6 to 91/-
Glengarnock, No. 3	—
Eglinton, No. 3	90/6 to 91/-
Gartsherrie, No. 3	90/6 to 91/-
Monkland, No. 3	90/6 to 91/-
Shotts, No. 3	90/6 to 91/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£	s.	d.		£	s.	d.
Bars (cr.)	10	0	0	to	10	15	0
Nut and bolt iron	8	15	0	to	9	0	0
Hoops	10	15	0	to	12	0	0
Marked bars (Staffs) f.o t.					12	10	0
Gas strip	10	15	0	to	12	0	0
Bolts and nuts, ¾ in. × 4 in.					14	5	0

Steel—							
Ship plates	8	15	0	to	8	17	6
Boiler plts.	9	5	0	to	10	5	0
Chequer plts.					10	12	6
Angles					8	7	6
Tees					9	7	6
Joists					8	15	0
Rounds and squares, 3 in. to 5½ in.					9	7	6
Rounds under 3 in. to ¾ in. (Untested)					7	12	6
					and upwards		
Flats—8 in. wide and over					8	12	6
„ under 8 in. and over 5in.					8	17	6
Rails, heavy					8	10	0
Fishplates					12	0	0
Hoops (Staffs)	9	5	0	to	9	10	0
Black sheets, 24g.	8	12	6	to	9	12	6
Galv.cor.shts., 24g.					11	5	0
Galv. fencing wire, 8g. plain					12	0	0
Billets, soft	5	10	0	& up.			
Billets, hard	7	2	6	& up.			
Sheet bars	5	0	0	to	5	12	6
Tin bars	5	0	0	to	5	12	6

PHOSPHOR BRONZE.

Per lb. basis.

Strip	1/0½
Sheet to 10 w.g.	1/0½
Wire	1/1
Rods	1/0½
Tubes	1/5½
Castings	1/0½

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. CLIFFORD & SON, LIMITED.

NICKEL SILVER, &c.

	per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
3/0 to 10 G.	1/4½ to 1/11½

with extras according to gauge.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	17.76
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	14.00
Basic	18.76
Bessemer	19.26
Malleable	19.26
Grey forge	18.26
Ferro-mang. 80%	94.00
O.-h. rails, h'y, at mill	43.00
Billets	30.00
Sheet bars	30.00
Wire rods	36.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Skelp, sheared steel	1.60
Steel hoops	1.90
Sheets, black, No. 24	2.35
Sheets, galv., No. 24	2.90
Sheets, blue an'l'd, No. 13	2.05
Wire nails	1.90
Plain wire	2.30
Barbed wire, galv.	2.55
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	25/- to 27/6
„ furnace	15/- to 16/-
Durham and Northumberland—	
„ foundry	15/- to 15/6
„ furnace	14/6
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		15/6
„	28×20 „		31/-
„	20×10 „		22/9
„	18¾×14 „		16/3
C.W.	20×14 „		15/-
„	28×20 „		29/6
„	20×10 „		21/-
„	18¾×14 „		16/-
Terneplates	28×20		31/- per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6	0	0	to	£7	10	0
Bars, hammered, basis	£17	10	0	to	£18	10	0
Bars and nail-rods, rolled, basis	£15	17	6	to	£16	15	0
Blooms	£10	0	0	to	£12	0	0
Keg steel	£32	0	0	to	£33	0	0
Faggot steel	£20	0	0	to	£24	0	0
Bars and rods dead soft, steel	£11	0	0	to	£14	0	0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Over ½ in. up to 6 in.

	Tubes.	*Fittings.*
Gas	62½%	47½%
Water ..	58½%	42½%
Steam ..	55%	37½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.	
Jan.	15 ..	44	11	3	dec. 2/6
„	16 ..	44	11	3	No change
„	19 ..	45	12	6	inc. 21/3
„	20 ..	45	1	3	dec. 11/3
„	21 ..	45	0	0	„ 1/3

Electrolytic Copper.

		£	s.	d.	
Jan.	15 ..	47	0	0	No change
„	16 ..	47	0	0	„ „
„	19 ..	48	0	0	inc. 20/–
„	20 ..	47	10	0	dec. 10/–
„	21 ..	47	10	0	No change

Standard Tin (cash).

		£	s.	d.	
Jan.	15 ..	113	0	0	dec. 30/–
„	16 ..	114	0	0	inc. 20/–
„	19 ..	116	10	0	„ 50/–
„	20 ..	114	17	6	dec. 32/6
„	21 ..	117	5	0	inc. 47/6

Tin (English ingots).

		£	s.	d.	
Jan.	15 ..	114	2	6	dec. 42/6
„	16 ..	115	2	6	inc. 20/–
„	19 ..	117	12	6	„ 50/–
„	20 ..	116	0	0	dec. 32/6
„	21 ..	118	10	0	inc. 50/–

Zinc Sheets (English).

		£	s.	d.	
Jan.	15 ..	22	0	0	No change
„	16 ..	22	0	0	„ „
„	19 ..	22	0	0	„ „
„	20 ..	22	0	0	„ „
„	21 ..	22	0	0	„ „

Spelter (ordinary).

		£	s.	d.	
Jan.	15 ..	12	13	9	inc. 1/3
„	16 ..	12	8	9	dec. 5/–
„	19 ..	12	12	6	inc. 3/9
„	20 ..	12	11	3	dec. 1/3
„	21 ..	12	12	6	inc. 1/3

Lead (English).

		£	s.	d.	
Jan.	15 ..	15	10	0	No change
„	16 ..	15	5	0	dec. 5/–
„	19 ..	15	5	0	No change
„	20 ..	15	5	0	„ „
„	21 ..	15	0	0	dec. 5/–

AVERAGE MONTHLY PRICES OF STEEL RAILS.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1908	6 2 6	6 0 0	6 0 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 15 0	5 10 0	5 16 3
1909	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0	5 5 0
1910	5 5 0	5 7 6	5 7 6	5 7 6	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 10 0	5 8 11½
1911	5 15 0	5 15 0	5 15 0	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 12 6	5 13 1½
1912	5 13 1	5 15 0	5 15 0	5 15 7	6 1 6	6 6 3	6 7 6	6 8 0	6 11 3	6 12 6	6 12 6	6 13 9	6 4 4
1913	6 15 0	6 14 4½	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 12 6	6 10 0	6 10 0	6 10 0	6 10 0	6 12 0
1914	6 10 0	6 10 0	6 6 3	6 0 0	6 0 0	6 0 0	5 14 0	6 2 6	6 13 9	6 12 0	6 7 6	6 7 6	6 5 3½
1915	6 10 6	6 17 6	7 5 0	7 12 6	7 12 6	7 17 6	8 17 6	9 2 6	9 2 6	9 2 6	9 7 6	10 10 6	8 6 6½
1916	10 19 4	11 0 0	11 0 0	10 18 9	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 9 10
1917	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1918	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1919	10 17 6	13 7 6	13 7 6	13 7 6	15 0 0	15 10 0	16 0 0	16 10 0	16 10 0	16 10 0	16 10 0	17 5 0	14 12 11
1920	18 15 0	19 7 0	20 7 6	22 0 0	23 0 0	23 0 0	24 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	22 18 11½
1921	23 5 0	20 4 0	18 0 0	17 0 0	15 0 0	15 0 0	14 0 0	14 0 0	14 0 0	11 12 6	10 10 0	10 0 0	15 4 3
1922	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 0 0	8 15 0	8 15 0	8 15 0	8 15 0	9 4 2
1923	8 17 6	9 2 0	10 5 0	10 10 0	10 10 0	10 10 0	9 15 0	9 0 0	8 15 0	8 15 0	8 19 0	9 5 0	9 9 10
1924	9 5 0	9 5 0	9 5 0	9 5 0	9 5 0	9 2 6	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 2 3½
1925	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 10 7½	8 10 0	8 10 0	8 10 0	8 4 0	8 0 0	8 0 0	8 11 7½
1926	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 10 0	8 3 11½
1927	8 10 0	8 10 0	8 10 0	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 3 0	8 5 0	8 5 0	8 4 10
1928	8 5 0	8 5 0	8 5 0	8 5 9	8 6 3	8 6 3	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 7 9½
1929	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1930	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0

AVERAGE MONTHLY PRICES OF EAST COAST HEMATITE AT MIDDLESBROUGH.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1915	83 11	88 6	94 8	107 0	102 6	101 3	98 9	98 7½	96 6	104 0	124 1	130 0	106 11½
1916	133 9	140 0	136 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	128 1½
1917	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1918	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1919	122 6	122 6	122 6	122 6	179 2	190 0	197 6	200 0	200 0	200 0	200 0	200 0	171 4
1920	220 0	220 0	240 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	251 8
1921	240 0	220 0	180 0	180 0	180 0	160 0	160 0	160 0	137 0	127 6	117 6	104 6	162 2
1922	97 6	91 7½	100 0	98 6	97 1½	94 7	93 6	90 9	89 7	91 10½	93 0	93 2	94 5½
1923	94 6	104 9	122 0	126 10½	122 0	115 3	107 0	98 8½	98 10½	99 1½	100 6½	102 3	107 10½
1924	102 4½	101 3	99 7½	99 0	98 9½	97 4½	95 3½	93 1½	90 7½	88 0	88 4½	88 5	95 2½
1925	87 5	85 9	84 7½	82 6	80 10½	79 3	77 1½	75 7½	75 0	74 3½	74 9	76 0	79 5½
1926	77 3	77 9	77 3½	76 3	77 4½	78 0	79 8½	81 9	83 4½	87 7½	92 6	90 5½	81 7½
1927	90 0	90 0	86 3½	83 1½	80 6	78 0	76 6	75 4½	75 0	72 9	71 9	71 1½	79 2½
1928	69 7½	69 7½	69 9	70 0	70 0	69 3	68 7½	69 2	70 0	70 0	70 3	71 0	69 9½
1929	71 6	72 0	73 6	74 0	74 0	74 1½	74 9	75 6	76 1½	76 8½	78 1½	79 0	74 11½
1930	78 2½	78 0	76 9	75 0	74 0	72 7½	71 0	71 0	71 0	71 0	70 10½	70 4½	73 3½

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(A remittance should accompany instructions.)

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